A Sociolinguistic Survey of (t,d) deletion, (t) glottaling, and their intersection in East Anglian English

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To my beloved grandmother, Angelina, to whom I promised
to dedicate this thesis before she left this world.

You will always be in my heart,
in my mind.

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Abstract

This thesis examines two well-studied phonological features - (t,d) deletion and (t) glottaling – in East Anglian English by maintaining the structuralist roots of the variationist paradigm (e.g. Wolfram 1993; Patrick 1999). It also investigates, for the first time, the covariation between the two linguistic variables by exploring the intersection of (t) deletion and (t) glottaling in word-final consonant clusters (e.g. *different*). (t,d) deletion has been largely investigated in US English dialects, yet it has received comparatively little attention in the UK. (t) glottaling has been widely examined as a change in progress in England (including Norwich, Trudgill, 1974, 1988) and Scotland, yet little research on this variable has been carried out in Ipswich (Straw & Patrick, 2007) or Colchester.

Data was gathered in three East Anglian speech communities: Colchester, Ipswich and Norwich, where 36 participants, equally distributed, have been recorded by means of sociolinguistic interviews, reading passages and word lists. Mixed-effects Rbrul regression analysis was carried out.

(t,d) results are in line with previous US studies showing that (t,d) absence is primarily conditioned by linguistic factors and its profile is that of a stable variable. A more fine-grained analysis is suggested for the following phonological environment.

For (t) glottaling, this thesis also proposes a closer inspection of the following phonological environment. The preceding phonological context - little explored in previous studies - plays a notable role. While word-final /t/ glottaling has completed its social change and is spreading in phonological space even in environments where it used to be blocked, word-medial /t/ is both phonetically and socially conditioned.

The covariation between (t) glottaling and (t) deletion shows that the transition glottaling → deletion, in the lenition scale, is in *feeding* order and is mostly linguistically driven. In this analysis, women exhibit a higher use of glottal variants, whereas males promote deletion – the last stage of the lenition scale

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Structure of the thesis

This thesis begins with an introductory Chapter which outlines the purpose of this work; it explains the motivations to study East Anglian English, starting with a discussion which aims at defining what is meant by linguistic East Anglia. It provides an insight into Colchester, Ipswich and Norwich from which the data has been collected and addresses the research questions of the present survey. Finally, this Chapter briefly summarises the origin of the sociolinguistic paradigm and reviews the use of social variables within the sociolinguistic theory.

Chapter 2 focuses on fieldwork and the methods employed in the present study, with considerations on the coding procedure. It provides a brief outline of the two dependent variables - (t,d) deletion and (t) glottaling – as well as a brief outline of the internal and external constraints employed in the present research.

Chapter 3 presents a phonetic, phonological, and sociolinguistic description of the (t,d) variable tracing also its diachronic profile. It selectively reviews the empirical findings from North American (t,d) studies along with systematic research carried out in the UK, and it reviews (t,d) deletion on theoretical grounds.

Chapter 4 presents and discusses results of (t,d) deletion in East Anglian English. Firstly, the overall results from the three localities (Colchester, Ipswich and Norwich) are examined together; secondly, the three urban areas are explored separately in order to investigate the behaviour of the independent variables and their related patterns in each locality.

Chapter 5 reviews the literature of (t) glottaling and its diachronic development, starting with a phonetic and phonological description of /t/. This variable is explored within

phonological and sociolinguistic theories, with a summary of empirical findings in the UK and in other English-speaking areas (e.g. in the USA).

Chapter 6 presents and discusses the findings of (t) glottaling in East Anglia. Initially, the overall results (the three localities together) are investigated; secondly, the three localities are analysed separately.

Chapter 7 explores (t) deletion and (t) glottaling at their intersection in word-final consonant cluster. It reviews the concept of co-variation between phonological variables as well as the notion of lenition. Finally, it presents and discusses the overall results from the three urban areas.

Chapter 8 summarises the findings, draws conclusions and summarises the research questions which are answered throughout this work.

Chapter 1 - INTRODUCTION

This work is a synchronic survey of urban East Anglian English and it is rooted in the sociolinguistic paradigm. Urban sociolinguistic studies set out to describe language as a social phenomenon, attempting to establish relationships between language and society, and "pursuing the complementary questions of what language contributes to making community possible and how communities shape their languages by using them" (Coulmas, 1997: 2). The two variables selected for this survey are two well-studied phonological features: (t,d) deletion in word final consonant clusters, which has received wide attention in many US English dialects, and (t) glottaling, which has been largely explored in the UK. Through the employment of quantitative methods, this study attempts not to reach conclusions based only on single details, but also takes into account patterns of variation distinguishing "the shape of the forest through all the trees" as Guy (2014: 196) suggests.

This research project, which is carried out in the South East of England – precisely in East Anglia - is largely inspired by the Labovian framework, which laid the basis for variationist studies (e.g. Trudgill (1974) in Norwich).

1.1 Motivations to examine (t,d) and (t) in East Anglian English

The East Anglian English variety has been widely investigated by Trudgill (1974, 1988, 1999, 2003) over the years. While most of his systematic work is devoted to a particular region – Norfolk[1] - little systematic research has been carried out in Suffolk (Kokeritz

[1] It should be noted that the borders of Norfolk, or more precisely of Norfolk dialect as intended here, do not line up with political borders. Indeed, linguistically, its definition also includes some northern Suffolk towns, such as Southwold and Lowestoft (Trudgill, 2004a).

1932; Potter, 2018) or Essex (Altendorf, 2003). Britain (2020: 14) has recently claimed that despite a few multilocality studies, "no research has been able to provide a picture of the state of the traditional dialect *across the whole* [East Anglian] *region"*. This study provides a contribution in this respect as it investigates (t,d) deletion and (t) glottaling in the speech communities of Colchester (Essex), Ipswich (Suffolk), and Norwich (Norfolk), as illustrated in figure 1.1.1. Before reviewing the concept of 'speech community', let us firstly define East Anglia in both geographical and linguistic terms.

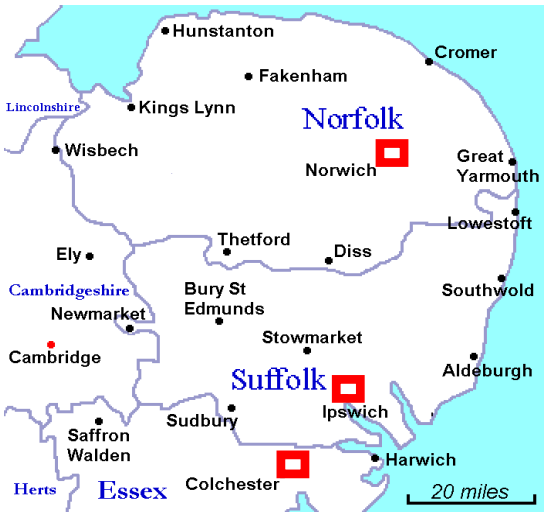

Figure 1.1.1 Geographical location of Colchester, Ipswich, and Norwich.

1.2 East Anglian history and borders

The constitution of East Anglia as we know it today seems to date back to the fifth century when Angles, Saxons and Jutes, from the north-west European continent, began their settlement in the British Isles. On their arrival, the Angles who occupied the east part of Britain mainly settled in Norfolk and Suffolk, including the bordered areas to the south and to the west; whereas, "Essex and Cambridgeshire – were distinct from the very beginning by reason of being mainly Saxon" (Trudgill, 2003: 23). During the Roman invasion, the north Essex town of Colchester was the capital of Britain and

the queen of the British Celtic Iceni tribe was Boudica (Finchman, 1976). The Iceni, or the Brittonic tribe of eastern Britain, included the current county of Norfolk, parts of Suffolk and Cambridgeshire as well as neighbouring areas such as Corieltauvi to the west (the current East Midlands), Catuvellauni (the current Bedfordshire, Buckinghamshire, and Hertfordshire) and Trinovantes (the current north Essex and south Suffolk). The first significant battle in East Anglian history was documented around AD 61 when the uprising of the East Anglian Iceni tribe against the Romans was taking place - the latter ended with the death of the queen Boudica (Finchman, 1976).

Martin (1999) reports that the names "Suffolk" and "Norfolk" were first recorded in the 1040s (cf Dymond & Northeast 1985). These two place names, which referred to the self-governing area in the British Isles, literally mean "the north/south folk of the Kingdom of East Anglia", yet it is unknown when the two current counties became separate. It is assumed that this might have happened during the 5th - 7th centuries when the Germanic tribes settled in Britain. The dialectal similarities between Suffolk and Norfolk could be explained by the fact that, originally, the Kingdom of East Anglia was considered one cultural and linguistic area (Trudgill, 2003). However, Trudgill (2003) adds that cultural and dialectal differences between these two entities subsequently surfaced owing to difficulties to traverse the land around the River Waveney – a barrier of communication between the 'north folk' and 'south folk' which limited the dialectal contact. In his commentary on boundaries of East Anglia, Trudgill (2004a: 163) reveals that the borders of this area are still a debated issue:

> "As a modern topographical and cultural term, *East Anglia* refers to an area with no official status. Like similar terms such as "The Midlands" or "The Midwest", the term is widely understood but stands for an area which has no clear boundaries. Most people would agree that the English counties of Norfolk and Suffolk are prototypically East Anglian, although even here the status of the Fenland areas of western Norfolk and north western

> Suffolk is ambiguous: the Fens were for the most part uninhabited until the 17th century, and the cultural orientations of this area are therefore less clear. The main issue, however, has to do with the extent to which the neighbouring counties, notably Cambridgeshire and Essex, are East Anglian or not."

As he explains, there seems to be no hesitation in considering Norfolk and Suffolk a part of East Anglia - two counties which embrace all the traditional East Anglian features (see footnote 4) and meet the North Sea. The issue is how to interpret the western and southern borders (Martin, 1999). As pointed out by Britain (2001) the Fens were largely unpopulated until lately, hence its status made it onerous to assess. Trudgill (2001) adds that if the Fenland were not to be included in East Anglia, even the Fens which are part of Norfolk will have an ambivalent status. Moreover, he explains that if the label "East Anglia" comprises the Fens, then Lincolnshire, Cambridgeshire, Huntingdonshire[2], and the Soke of Peterborough[3] should also be included. Other historical sources (e.g. Wilson 1977) also include Essex, Bedfordshire and Hertfordshire; this means that the status of these counties should also be taken into account (Trudgill, 2001).

To shed light on which neighbouring counties belong to this area, Trudgill (2001a) draws isoglosses which illustrate the distribution of seven linguistic features[4] by using data from *The Survey of English Dialects* (SED). His map (p. 11) demonstrates that the geographical extent of what he calls 'linguistic East Anglia' can be divided into

[2] Currently, this area is part of Cambridgeshire (Trudgill, 2001).
[3] Currently, this area is part of Cambridgeshire, but historically belonged to Northamptonshire (Trudgill, 2001).
[4] The seven features illustrated include (1) verbal -s marking (also referred to as third person singular zero); (2) lack of /h/ dropping; (3) presence of glottaling and glottalisation; (4) the realisation of the BATH vowel with the open front [a:], as in *bath*; (5) the realisation of the NURSE vowel as /ɐ/, in words like *church*; (6) short /ɪ/ realised with the schwa, as in *suet*; and (7) the realisation of the GOAT vowel with /ʊ/ in *road* and *both.* With respect to the GOAT vowel, Trudgill (2004a) notes that words like *rowed* are realised as [ʌu] in the northern region, whereas words like *road* are realised as [u:~ʊ]; in the southern region *road* and *rowed* are both commonly articulated as [ʌu]. See Butcher (2019) for recent research on the GOAT vowel in Suffolk.

a core zone surrounded by nearly all Norfolk and Suffolk, whose boundaries are delimited to south and west by a transition zone. The latter is partly marked by the Fens[5] and represents both a geographical and linguistic transition. Britain (2013) observed that linguistic features which represent a transition from East Anglia to the East and Midlands include /h/ dropping, with the dropped voiceless fricative to the west and Midlands, and present [h] in East Anglia; /ɪ/ in unstressed syllables is articulated as [ɪ] to the west, while to the east it is realised as a schwa; the MOUTH vowel is realised with the open-mid form [ɛː] to the west, similarly to the Midlands, whereas to the east is realised as [ɛu]; the typical East Anglian verbal -s marking was found not to be present in dialects spoken in the Fens. Not only does the Fenland function as transition area between East Anglia and the Midlands, but it sets linguistic boundaries between the north and the south of England, such as the TRAP- BATH split, and the FOOT- STRUT split.[6] Having highlighted some of the most notable differences between west, Midlands, and east of England, let us turn to the starting point: establishing the East Anglia boundaries; according to Trudgill (2001a: 10):

> "East Anglia, from a linguistic perspective, consists of all of Norfolk and Suffolk apart from the Fens, and part of northeastern Essex. The transitional area consists of the Norfolk, Suffolk and Cambridgeshire Fens plus most of the rest of Cambridgeshire, central Essex, and a small area of northeastern Hertfordshire."

[5] See Britain (2001, 2013) for further details on linguistic variation in the Fens.
[6] See Britain (2001, 2013) for further details.

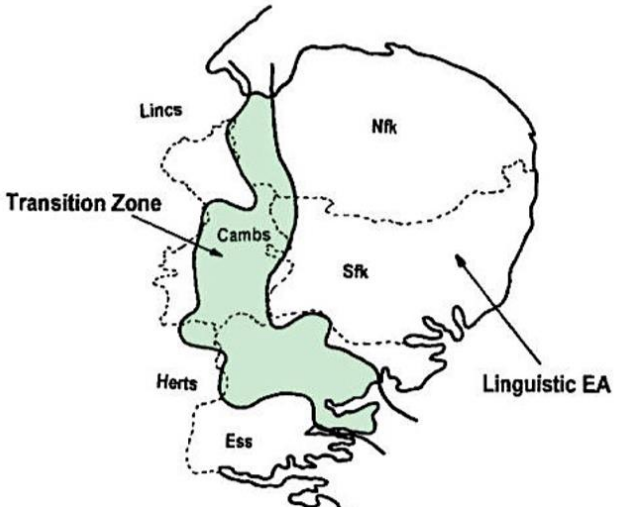

Figure 1.2.1 Map representing linguistic East Anglia and the transition zone. Adapted from Trudgill (2001, 2018).

North Essex, as Trudgill (2004a, 2018) explains, includes the town of Colchester and its neighbouring area. This survey employs the above definition of linguistic East Anglia, despite the decrease in size of both core and transition zones due to supralocal dialect levelling (Trudgill 2003, 2004a).

1.3 Urban areas and speech communities

This section firstly explains what is meant by "urban" area and secondly provides a brief review of the concept of speech community. The definition of "urban" area, provided by the UK government, is related to the size of their population. Johnston (1994: 651) states that an urban area "exceed[s] the thresholds of population size and/or density which are frequently used in census definitions of urban places." Cloke et al. (2014: 688) uphold that the concept of "urban" is sometimes taken for granted and used "in an almost unthinking manner." By contrast, a core concept in sociolinguistics which is not taken for granted is that of speech community. Traditionally, the term speech community is referred to as "all people who use a given language" (e.g. Lyons, 1970 cited in Patrick 2002: 579). However, Patrick (2002) shows that the concept of speech

community intersects with many issues within sociolinguistic theory and, sometimes, has been considered onerous to explore (e.g. Fasold, 1984). The most influential conception of speech community was provided by Labov (1972) because, as Patrick (2002) highlights, it is "more empirically-rooted, less generalised" compared to other theories by Hymes or Gumperz (Patrick 2002: 584)[7]. Indeed, Labov (1994) argues that the speech community is not an assumption or a theory, rather it is the outcome of empirical research. Despite being greatly influential, Labov's definition of speech community has been subject to criticism. Britain and Matsumoto (2005: 7), for instance, criticise the fact that he did not include non-native speakers in his New York sample yet, Patrick (2002: 589) points out that "the legitimacy of analytical choices [...] depends upon selection of the research question, in addition to the site."

Speech communities may also overlap with one another, thus it is suggested to conceptualise their intermediate structures (Patrick, 2002). Moreover, the speech community should not be treated as a component of social examination, as it is viewed as social unit used for linguistic analysis (Patrick, 2002).

Having outlined the difference between urban area and speech community, let us now explore more closely the three urban areas selected for this study.

1.3.1 Colchester

Colchester, a historic market town in the county of Essex, is considered Britain's oldest town founded by Romans. It is located 66 miles north-east of London. The borough of Colchester encompasses an area of 125 square miles (320 km^2) from Dedham Vale (Suffolk border) to Mersea Island. The population growth started between 1914-92, with an approximate increase of 10,000 between the two World Wars (Baggs et al.,

[7] See Patrick (2002) for a more detailed account on the conception of speech community.

1994). The 1801-1981 census recorded a population size of 43,452 in 1911; in 1951, the total population was 57,449, whereas in 1981 it grew by 82,227. This steady increase was influenced by the central government legislation for housing and town planning in 1921 as well as by the wide ancient boundaries within which Colchester was able to expand. After the Second World War, the community increased both southwards towards London as well as inwards from neighbouring villages and towns. Despite the marginal bomb damage, some slum clearance and new buildings were needed to minimise the population pressure on available housing. A total of 6,147 public and private houses were built between 1945 and 1961, housing a total population of 65,080. Many schools and Churches were built around 1914, and the University of Essex in 1961 (Baggs et al., 1994).

The 2011 UK Census reported a population of 173,074, with approximately 49.3% males, and 50.7% females. In terms of ethnicity, Colchester hosts 88% of White English/ Welsh / Scottish / Northern Irish / British; 0.6% is White Irish; 0.4% is White Gypsy or Irish Traveller; 4% belong to the Other White ethic group; the rest of the demographic density is composed of mixed/multiple ethnic groups, such as White and Black Caribbean (0.5%), White and Asian (0.5%), White and Black Africans (0.2%), Other Mixed (0.4%), Indians (0.8%), Pakistani (0.2%), Bangladeshi (0.2%), Chinese (0.9%), Other Asian (1%), Black African (1%), Black Caribbean (0.3%), Other Black (0.1%), Arab (0.5%), and 0.4% is included in the Other ethnic group.

The 2017-2018 Colchester Annual Economic Report shows a 9.8% increase of the demographic density since the 2011 Census, with an estimate of 190,100 inhabitants. The ONS Annual Population Survey 2017 reveals that, in this town, the employed and self-employed outnumber the unemployed. The number of unemployed people is lower compared with the unemployment rates on a national scale.

Location	Economically active	Unemployed	Retired
Colchester	75.6%	3.7%	13%
England and Wales	70%	4.5%	14%

Table 1.3.1 Census 2011 - Employment and unemployment data in Colchester, England and Wales (Nomis, 2011).

With respect to business demography, there has been a 12% rise in the number of businesses from 2010 to 2017. In terms of education, the population of Colchester is particularly higher skilled, with 89.1% people holding an NVQ1 or a higher qualification, while less than 4.1 % holds no qualification.

The approximated social grade provided by the UK government is divided in four categories: AB, which is the highest grade, covers “higher and intermediate managerial/administrative/professional occupations”; C1 relates to “supervisory, clerical and junior managerial/administrative/professional occupations”; C2 covers “skilled manual occupations”; DE, the lowest grade, includes “semi-skilled and unskilled manual occupations; unemployed and lowest grade occupations” (Nomis, 2013). 23% of the population holds the highest social grade (AB); 35% consists of non-manual workers (C1); 20% is involved in skilled manual occupations (C2); whereas 21% has the lowest social grade (DE).

1.3.2 Ipswich

The town of Ipswich is located about 80 miles north-east of London and it is a non-metropolitan district. The population started growing since the early 1800s when the number of inhabitants was 11,277, and had reached 66,630 by 1901 (Malster, 2000).

A significant expansion of the town was recorded after the Second World War, as numerous houses were built owing to bomb damage in the town[8]. As per request of the UK government, Londoners were also resettled in Ipswich and an approximate 70,000 people were included in the envisaged resettlement during the 1960s. Malster (2000) states that the expansion plan included local services such as schools, the town centre, etc. The 2011 Census shows that the Ipswich population is equal to 133,384 or 144,957 (49.8% males and 50.2% females) depending on the precise borders which surround the urban town (Nomis, 2013). 85.4% of people who live in this town belong to the White English/ Welsh/ Scottish/ Northern Irish / British ethnic group category; 0.5% is White Irish; 0.1% is White Gypsy or Irish Traveller; 5% is Other Whites; the rest of the demographic density is composed of mixed/multiple ethnic groups, such as: 0.4% is White and Black African, 0.4% is White and Asian, 1.75% is White and Black Caribbean; 0.7% of the population is composed by Other Mixed; 1.16% by Indians and 1.13% by Bangladeshi; 0.2% by Pakistani; 0.4% is Chinese; 0.1% is classified as 'other Asians'; 0.8% by Black Africans; 1% by Black Caribbean; 0.3% belongs to other ethnic groups; 0.1% by Arabs, and 0.6% by any other ethnic group.

The Census carried out in 2011 also reports 74% of the population are economically active; 5% are unemployed, whereas 12% are retired. Levels of economically active population and levels of unemployment are relatively higher compared to the overall rate for England and Wales.

[8] The Chantry estate, studied by Straw (2006), is an example.

Location	Economically active	Unemployed	Retired
Ipswich	74%	5%	12%
England and Wales	70%	4.5%	14%

Table 1.3.2 Census 2011 - Employment and unemployment data in Ipswich, England and Wales (Nomis, 2011).

The Suffolk Haven Gateway Employment Land Review 2009 describes the changes which occurred in the Ipswich economy over the last twenty-five years. During this time period, there has been a notable increase in tertiary sector activities, with an approximate rate of 80% of the total employment. According to the East of England Forecasting Model (2016), this town has recently experienced a steady growth in job numbers as, between 2001 and 2016, 5,330 additional jobs were registered.

The approximated social grade provided by the UK government shows that 18% of the Ipswich population has the highest social grade (AB); 28% is included in the C1 category; 25% is included C2, whilst 30% holds the lowest social grade (DE).

82.5% of the Ipswich population holds NVQ1 and above, whereas 8.4% holds no qualifications.

Ipswich is also mentioned in several works of literature; it has been used as a setting by Charles Dickens for his novel *The Pickwick Papers*, and it is also mentioned in the *Canterbury Tales* where Chaucer criticises the Ipswich merchants.

1.3.3 Norwich

The city of Norwich is located in the county of Norfolk, along the River Wensum, and lies about 100 miles from London. The city lays north of the A47 – the principal connection which links Norwich with Great Yarmouth to the east and Kings Lynn to the west. It is well-connected to London Liverpool Street via the National railway station, which provides an hourly service, and it is well-linked to the Midlands. Norwich is deemed to be the capital of East Anglia as, for centuries, it was the second largest city in England (after London). This suggests that it is "of considerable cultural and commercial importance for the surrounding area of Norfolk and indeed for East Anglia as a whole" (Trudgill, 1974: 6). The Second World War brought about notable damage in large parts of the city, with the highest number of casualties in the East of England. In 1945, the City of Norwich Plan was developed to supply a massive redevelopment of the area.

According to the Census carried out in 2011, the population of Norwich had 132,512 inhabitants, with 49% males and 51% females. With respect to ethnicity, the Norwich economic assessment 2018 reports an approximate rate of 84.7% of white English /Welsh /Scottish /Northern Irish /British; 0.7% is White Irish; 0.1% is White Gypsy or Irish Traveller; 5.4% of the population represents the Other White ethnic group category, where the largest growth (2.7% points) has taken place[9]. The rest of the demographic density is composed of mixed/multiple ethnic groups: White and Black Caribbean (0.5 %), White and Black African (0.5%), White Asian (0.7%); Other Mixed groups (0.6%), Indian (1.3%), Pakistani (0.2%), Bangladeshi (0.4%), Chinese (1.3%), Other Asian (1.3%), Black African (1.3%), Black Caribbean (0.2%), Other Black (0.1%), Arab (0.5%), any other ethnic group (0.4%).

[9] It is believed that this rise is prompted by immigration from Eastern Europe.

68% of the population is economically active – a rate which is slightly lower compared to that of England and Wales, as illustrated in table below:

Location	Economically active	Unemployed	Retired
Norwich	68%	5%	11%
England and Wales	70%	4.5%	14%

Table 1.3.3 Census 2011 - Employment and unemployment data in Norwich, England and Wales (Nomis, 2011).

83.5% of the Norwich population holds NVQ1 and above, whilst 10.6% holds no qualifications. The approximated social grade provided by the UK government shows that 20% of the Norwich population holds the highest social grade (AB); 31% consists of non-manual workers (C1); 18% consists of skilled workers (C2); whereas 30% holds the lowest social grade (DE).

1.4 Broad research questions

Having described the settings, the demographic density, and the economic profile of Colchester, Ipswich and Norwich, let us turn the attention to the research questions which aim at exploring the language use of these three East Anglian localities from a variationist sociolinguistic perspective. As mentioned earlier, the two linguistic variables selected for this study include (t,d) deletion and (t) glottaling. But why study (t,d) deletion and (t) glottaling in East Anglia? (t,d) deletion has been largely investigated in many North American studies, where the profile of (t,d) is that of a stable variable; comparably (t,d) has received little attention in the UK, where (t,d) was mainly researched in Northern varieties of British English, as in York (Tagliamonte &

Temple, 2005), Manchester (Baranowski & Turton, 2020) and in Tyneside English (Woolford, 2018). Despite slight differences in constraint ranking, phonological and morphological constraints were found to be largely uniform in North American studies; conversely, opposite results were found in the UK: in York (Tagliamonte & Temple, 2005) (see section 3.8.1) morphological class did not reach statistical significance, whereas data from Manchester (Baranowski & Turton, 2020) (see section 3.8.2) and Tyneside English (Woolford, 2018) (see section 3.8.3) exhibit the usual robust morphological effect in line with US findings (see Chapter 3 for further details). In view of these conflicting findings, the present survey set out to shed light on the unsolved problem of morphological constraints for (t,d) in British English dialects. In doing so, (t,d) will be treated as a single variable following the vast majority of studies. In order to provide a thorough description of (t,d) deletion in word-final consonant clusters (e.g. *want*), we should necessarily investigate (t) glottaling - a typical phonological feature of East Anglia – which intersects with (t) deletion, as in the following lenition scale: /want/ → [wɒnt] → [wɒnʔ] → [wɒnØ].

(t) glottaling has been widely investigated in this area (e.g. Norwich) in both apparent time and real time (Trudgill 1974; 1988), yet little systematic research has been conducted in Ipswich and Colchester. Previous work reports lack of gender and social class effects in some communities (e.g. Manchester), accompanied by high rates, hence the use of word-final /t/ glottaling is suggested to be an advanced change nearing completion (Baranowski & Turton, 2015).

With respect to (t,d) deletion, the research questions addressed in this survey broadly ask:

1) How does (t,d) behave in East Anglia?
2) Is the morphological effect present or absent in East Anglian English?

3) Is it worth providing a more fine-grained analysis of the following phonetic environment?
4) Do external (i.e. social) factors play a notable role?[10]
5) Do Colchester, Ipswich and Norwich exhibit similar patterns?[11]

With respect to (t) glottaling, the research questions ask:

1) How does (t) glottaling behave in East Anglia?
2) Is the variability of word-final /t/ glottaling conditioned by phonological factors only?
3) Is word-medial /t/ behind word-final /t/ glottaling in the change?
4) Do external (i.e. social) factors play a notable role?
5) Do Colchester, Ipswich and Norwich exhibit similar patterns?

A far more detailed account on research questions with descriptive and theoretical inquiries, and hypothesis is provided in Chapter 3 (section 3.6) and Chapter 5 (section 5.10), following the respective literature reviews of (t,d) deletion and (t) glottaling.

With respect to the intersection of (t) deletion and (t) glottaling in word-final consonant cluster, the research question asks:

1) How does (t) glottaling and (t) deletion behave when the two variables are explored at their intersection? Do frequencies of deletion and glottaling change? How should they be properly counted?

[10] In previous (t,d) studies, as will be outlined in Chapter 3, social factors played a marginal role. However, in Tyneside English (Woolford (2018) external factors were marked as significant constraints.
[11] This survey is an urban sociolinguistic study and it is not integrated into a spatial framework. While geographical space was found to be of importance for language variation and change (e.g. Britain, 2013), this study does not employ the use of wave and gravity models to investigate the diffusion of these variables across geographical space.

1.5 Summary

This Chapter sought to explain the motivations of investigating (t,d) deletion and (t) glottaling in East Anglian English by presenting a summary of research questions (RQs will be discussed in more detail in sections 3.7 and 5.10). It has also provided a geographical, historical, economic and cultural account of the three speech communities examined.

Chapter 2 - FIELDWORK AND METHODS

This Chapter primarily focuses on the fieldwork and methods employed to carry out the present study by highlighting the quantitative paradigm of variationist research pioneered by Labov. Before providing details of such methodology, this chapter outlines sampling methods as well as fieldwork considerations. I will then provide a brief overview on the early techniques adopted prior to the development of modern sociolinguistic methods. This discussion leads us to consider the principles of sampling as a *trait d'union* between research design and research goals.

2.1 The sample

The sampling procedure is a valued step that challenges any sociolinguistic researcher in order to guarantee representativeness. The latter - a key for social scientific studies - defines the level of accuracy of a sample enabling researchers to draw conclusions on the larger population under investigation (Milroy & Gordon, 2003).

The first sociolinguistic surveys followed a particular protocol (*sample frame*) by enumerating the relevant population, and by randomly selecting the individuals from that particular research site. This random sampling method, pioneered by Labov (1966), aimed at providing an equal opportunity to all members of the population to take part in the case study by ensuring objectivity and avoiding bias. Consequently, Labov developed a *secondary random sample*. Schilling (2013) argues that lists such as telephone directory used to randomly select the informants are themselves biased.

In the case of directory lists, for instance, people with only mobile phones are excluded and not all those randomly selected may be willing to participate.

Trudgill (1974)'s sample was defined as *quasi-random* and was taken from four ward voter registration lists. The label *quasi-random* springs from the methodology adopted which is random in the selection of names, but it is not random in the selection of the wards.

The *quota* or *judgment* sample, employed in Labov's work in Martha's Vineyard (1963), has been generally adopted in sociolinguistic research, such as in the Veeton study (Patrick, 1999) where social network approach and a judgment sample were combined. Participants, with this sampling technique, are chosen to fill pre-selected cells related to social factors. In other words, "the researcher (1) identifies in advance the types of speakers to be studied; and, (2) seeks out a quota of speakers who fit the specified categories" (Tagliamonte, 2006: 23). Schilling (2013) argues that this method ensures that social variable cells are filled, providing a *trait d'union* between research design and research goals. Indeed, to achieve a representative account it is necessary not to lose sight of the main research goals.

This means that if one's aim is to describe the whole population, selecting speakers only from a sub-group would be a clear bias. Romaine (1980) considers the validity of sampling procedures claiming that very small samples might not ensure statistical representativeness. Sankoff (1980a) has summarised three crucial decisions to be made prior to starting data collection:

1) to define the sampling universe (i.e. a group or a community in which the researcher is interested.)
2) to evaluate language variation within the population;
3) to determine the sample size.

Milroy & Gordon (2003) suggest that researchers should be aware of the way they adopt the definition of sampling universe as it may have an influence on their results.

To assess the variation within the community, Trudgill (1986) shows that the definition of 'native speaker' may be problematic as some people have lived in Norwich all their lives, yet they did not acquire the Norwich accent. Similarly, Payne (1980) shows that it is onerous for the children whose parents speak different dialects to acquire the dialectal pattern of the community in which they were born. This decision, as shown by Horvath (1985), may lead to relevant theoretical observations, such as the role of ethnic minority speakers who were leading linguistic changes in the speech community of Sydney. Another example of this kind is provided by Wolfram (1969) who focused on African American English in Detroit - a unique ethnic dialect. Since many African Americans speak Standard English natively, Wolfram et al. also included European Americans in the sample to compare the standard end of the dialect continuum.

To determine the sample size by using a stratified sampling technique, Milroy & Gordon (2003) suggest that if researchers aim to analyse informants from four social classes, both sexes and four age groups, they will need 32 cells. To balance the social parameters, for the present survey, I adopted a judgment sample which consists of 36 East Anglian speakers, as illustrated in table 2.1.1. For class divisions see section 2.8.

East Anglia											
Working Class						Middle Class					
Young (18-28)		Middle (35-50)		Old (60+)		Young (18-28)		Middle (35-50)		Old (60+)	
M	F	M	F	M	F	M	F	M	F	M	F
3	3	3	3	3	3	3	3	3	3	3	3

Table 2.1.1. Fieldwork sample design employed in the East Anglian study.

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Since the main goal of this study is to investigate East Anglian English, the boundary to define the sampling universe is taken from Trudgill's (2001a) definition of linguistic

East Anglia, as outlined in the previous Chapter. On the basis of what Trudgill defines as linguistic East Anglia, I identified three research sites for the sample design: Colchester, Ipswich and Norwich, where participants are proportionally distributed. Similar research designs relate to contemporary studies carried by Watt et al. (2019) and by Leemann et al. (2019). Watt et al. (2019) examined the correspondences between vowel phoneme boundaries in North-East England dialects, where a total number of 31 individuals from Newcastle, Sunderland, and Middlesbrough was analysed. Leemann et al. (2019) investigated the FOOT - STRUT split as well as the TRAP - BATH split in 12 localities across England (Birmingham, Bristol, Leeds, Liverpool, London, Manchester, Newcastle-upon-Tyne, Norwich, Nottingham, Peterborough, Sheffield, York), with an average of 10-12 speakers per locality, aged between 18 and 30.

2.2 The Fieldworker "away from home"

After selecting the communities and obtaining the ethical approval of research involving human participants, as required by the University of Essex, I started my data collection. Carrying out successful fieldwork is a central, if not the most crucial, part of a study. However, Schreier (2013) notes that despite its pivotal role, it is uncontroversial that fieldwork process does not usually have a prominent place in some sociolinguistic PhD theses, where usually the discussion on how the data was gathered lack details. The fieldworker needs to have an in-depth knowledge of the community that will be investigated (its setting, the population density, the social and economic character, history of both community and speakers, work and leisure, etc.), but this is not a great problem if researchers study the community where they grew up (e.g. Trudgill in Norwich, Britain in the English Fens, etc.). However, Schreier (2013: 25)

points out that a wide number of fieldworkers, if not the majority, conducts research in unfamiliar communities and they are known as fieldworkers who work *"away from home"*- (e.g. Eckert in Detroit, Wolfram in Washington DC and North Carolina, Nagy in Faetar (Italy), Kasstan in the Monts du Lyonnais (France) and in the Canton of Valais (Switzerland), Lacoste in Jamaica, etc.). Clearly, this requires researchers to develop an exhaustive knowledge of both the local culture and speech prior to data collection activities.

My status as investigator belongs to the category of fieldworkers *"away from home."* Many theoretical linguists praise native speaker investigators considering the fieldworker's use of language a crucial methodological issue. However, much linguistics research (e.g. Caribbean creole studies) is based on data collected by non-native or even non-speakers of the creole language investigated (Patrick, 1999). The communication with interlocutors, in these cases, could be problematic if the informants accommodate to the investigator's speech as a result of the convergence process.

Living in Colchester for several years has also helped me to absorb the local culture, political events, leisure activities, local geography and many other aspects of daily routine that validate me as a member of the community life.

2.3. Entering the communities

Fieldwork for this project started in July 2017 and was carried out for 11 months. I have lived in Colchester during the data collection and I would make constant trips to Ipswich and Norwich. There is no need to deny that the first stage of my data collection, especially in Ipswich and Norwich, was comparable to the nightmares that Eckert (2000) described before beginning her fieldwork in Detroit.

For the first two months, the data was gathered in the three communities to conduct a small-scale pilot study. The latter is a key factor for a good study design (Feagin, 2002) which provides two salient benefits: (1) valuable insights into the variables under investigation; (2) it "helps you see what kind of an interviewer you are" (Johnstone, 2000: 114). This self-evaluation allows researchers to see whether it is beneficial to conduct an unstructured interview where the informants lead the topic shift, or whether researchers manage to stick closely to the pre-designed topics being aware that in this case the data gathered will not be representative of the everyday casual speech (see section 2.4).

To enter the three communities, I adopted two basic strategies: (1) the *friend-of-a-friend* technique (Milroy, 1980) and (2) "through persons who are centrally located in social institutions" with an overview on the community (Labov, 1984: 31). The first approach allows the fieldworker to be an observer and a member in the community at the same time due to entangled obligations, which spring from the help received in recruiting the participants (Wolfram & Schilling-Estes 1998; Tagliamonte 2006). Labov (1982: 173) states that "a linguist who has gathered data in a speech community has an obligation to act in the interests of members of that community, when they have need of it". In some cases, he suggests paying back the community by using the knowledge gained from the data for the benefit of the community, maintaining the confidentiality of their data. To this "Principle of the debt incurred", Johnstone (2000) adds that sometimes this is not always practically possible, as some participants might not be interested in the results. Hence, an additional option could be helping the participants with their daily activities[1] - as was the case in this study.

[1] David Britain, for instance, brought groceries for his participants, Jenny Amos gave lifts to her informants, others would help with children's homework, etc.

The second approach I adopted to enter the communities (via institutions) should be considered carefully as making contacts only with people who hold an official status could bias the data towards the standard speech style, and the study will not be representative of the whole (Tagliamonte, 2006). In this respect, Labov (1984) found this strategy to be most effective when recruiting middle-class speakers. Conversely, in the present survey, I employed this technique to interview mainly working class informants, and secondarily members of the middle class in the Ipswich community. The institution I turned to is one of the local Homecares, which provides personalised care and support to convalescents, elderly people, etc. The tasks performed by personal carers are related to daily routine and include assisting patients with bathing, dressing, moving and further personal needs, and they do not take over tasks which require a wide medical knowledge or training. When I contacted one of the supervisors in that Homecare, she showed promptly interest in my research and, after volunteering[2], she kindly recommended me to an extensive number of employees. Thus, I had the chance to interview many personal carers, as well as a limited number of office workers. Some of them, however, were not Ipswich born and bred, hence they were excluded. I also contacted by email other institutions, in both Ipswich and Norwich, such as libraries, theatres, student unions explaining the research project and asking for volunteers who were willing to participate, yet that proved fruitless. With some staff members, however, I exchanged multiple emails and we even scheduled an appointment, yet eventually it turned out that most of them were extremely busy to take part in an hour, or at least fifty-minute, interview.

These approaches aimed mostly at recruiting speakers from the young and middle generations, but seeing how unfruitful it was, to expand my network I signed

[2] Given her office-based position, as a supervisor, she was classified as a middle class member (see section 2.8, for more details related to the social stratification).

up to a Meet Up smartphone App which connects you with local people and events allowing you to make new friends. To expand my network towards the elderly residents in both Ipswich and Norwich I went to the respective conservative clubs, which are typically frequented by local people yet, sadly, I was told that the approval committee do not allow researchers to recruit participants in these clubs. Finally, some office workers in the Ipswich Museum helped me in gathering a number of older participants.

In Norwich, I also gained access to the community thanks to a former Essex student, who is Norwich born and bred; with the help of a PhD student at the University of East Anglia, and with the help of a barman who kindly recommended some clients. At the end of each interview, I would ask each participant to recommend other friends or relatives who could be interested and willing to take part in this study.

The *snowball method* was also adopted in Colchester, where my social network is wider having done my Master's at the University of Essex and having lived in the community for several years. I firstly contacted, via telephone, a friend who I used to attend lectures with; she introduced me to young and middle-aged working class speakers. I then contacted a supervisor[3] of the accommodation where I used to live as well as some employees at the University of Essex, who kindly guaranteed me to their middle class friends and colleagues.

As claimed by Feagin (2002), self-presentation plays a crucial role in the fieldwork: I was careful to dress appropriately wearing shirt and stockings especially when meeting elderly informants, yet I would occasionally wear blue jeans when interviewing young speakers. I would normally take along biscuits or chocolates to

[3] The term supervisor, here, is not to be intended as "the lower salariat" of the ESeC model (Rose et al., 2010) which includes supervisory occupations, yet it is referred to the *lower supervisory* category belonging to class 6. (See section 2.8 for further details).

make the interview less formal, paying particular attention in the selection of biscuits to avoid the crunch noise on the tape.

Moreover, my Italian identity proved advantageous mostly in Colchester and Ipswich where I met several participants with a surprising fervent passion for the Italian culture. In one particular occasion, while I was interviewing a middle class woman from Colchester, she drew my attention to the Italian flag lapel pin she was wearing as a strong admiration symbol for the art, fashion and food of Italy[4]. In Ipswich, I tape-recorded a middle-class man who kindly asked me to teach him some Italian words, at the end of the interview. On later visits to the community, I offered to give free Italian lessons to his kids, who apparently were seeking for a tutor.

Before each interview was carried out, I carefully followed the ethical protocol. Milroy & Gordon (2003) claim that a non-fulfilment of ethical guidelines may cause extreme implications to the research institutions, such as loss of reputation, loss of funding, etc. Each participant, prior to the recording session, was given a Consent Form adapted from a template of the Department of Language and Linguistics at the University of Essex, as well as a Participant Information Sheet (PIS). Johnstone (2000) emphasizes the importance of this stage as the participants gain awareness of what is involved in taking part in a research study, also becoming aware of their rights (e.g. the participant's rights to anonymity, confidentiality and withdrawal, etc.). In the PIS, I provided a brief introduction of the topic, explained why I am doing this project; what the participant will have to do if they agree to take part; and ensured them that the data will remain confidential. I also explained which are the advantages of taking part in a research project, and the disadvantages (e.g. feeling uncomfortable being recorded), and explained to them how I was going to use my data. Trechter (2013) points out that

[4] Note that all of my participants identified themselves as monolingual.

this moment of formality can increase the unwanted observer's paradox (see section 2.4), while the researcher is trying to elicit casual speech. A crucial step, at this point, requires breaking the ice without diminishing the role of the consent form that the participant has just signed.

2.4. The sociolinguistic interview

Labov (1984) suggests that a typical sociolinguistic interview should last at least one hour or two hours per speaker. Milroy & Gordon (2003), however, point out that sometimes it can be onerous to be categorical about the interview length, claiming that phonological data can be gathered in 20 or 30 minutes. In this study, the length of each one-to-one interview is about 50 or 60 minutes - only one lasted roughly half an hour. Milroy & Gordon (2003: 58), citing Douglas-Cowie (1978), claim that "even when interviewed by a stranger, speakers will settle down to a pattern approximating to their everyday interactional style after about the first hour." This is one of the principal reasons I would meet with my participants before interviewing them. Specifically, I would usually meet with my older participants a couple of hours before the actual interview started, while I would normally hang out for a couple of days with young speakers before the interview.

To be fruitful and successful, an interview should be cautiously planned. As outlined earlier in the Chapter, a sociolinguistic interview is not synonymous with free speech (e.g. conversations which arise among friends) due to the presence of a recording device. This may give rise to the observer's paradox which clashes with the purpose of sociolinguistic research to access the vernacular (i.e. a linguistic variety used by a speaker or a community for every day and home interaction) in order to "find

out how people talk when they are not being systematically observed; yet we can only obtain these data by systematic observation" (Labov, 1972: 209).

A structured sociolinguistic interview could potentially reduce the observer's paradox, if structured by specific modules. These interview modules, proposed by Labov (1984), include a number of questions which focus on a particular topic, such as children's games, the "danger of death", etc. Carrying out an unplanned interview can turn out in long-lasting questions, can be ambiguous and may lead to spontaneous speech phenomena such as hesitations and false starts. Labov suggests that it should take less than five seconds to deliver planned questions, and that questions should be formulated from an outsider's viewpoint. Moreover, it is recommended that the interviewer acts as a learner - an undemanding task for me, as an interviewer - especially in the communities of Ipswich and Norwich.

Topics which Labov describes as *conversational networks* are selected based on (a) previous successful subjects which engaged the participants in the conversation, and (b) topics which may yield information on neighbourhood norms and on more general ones. Each module, in my interviews, began with general questions, such as 'Did you go to one of the schools in the neighbourhood?' (Tagliamonte, 2006: 38) to measure a participant's level of interest in that topic. If a speaker is not particularly engaged with that topic, the interviewer moves on to further memorised questions which are more personal experience-based, such as "Did you ever get blamed for what you didn't do?" (Labov, 1984: 34). The order of topics such as childhood[5], games, family, dreams, work, marriage, Brexit, etc., was not always strictly followed as I had planned. This means that a shift of topic or a topic initiated from the participant has always been accepted to allow the speaker to feel relaxed and produce speech

[5] Such as, "Getting back when you were a kid, was there anyone you didn't like?" etc.

representative of their everyday language. Semi-structured approaches, therefore, also proved productive.

If the participants no longer answer questions, the interview is deemed a failure. Even if the informants cooperate, the interview should not be governed by "the cooperative principle" according to which they answer the questions briefly (Levinson, 1983: 100). Indeed, a crucial part of the interview is "the additional material that the speakers provide, beyond the initial question" (Labov, 1984: 38). Since it is onerous to elicit casual speech from the sociolinguistic interview, researchers typically ask questions that involve emotional reactions; in this case, the interviewees are more focused on what they say rather than how they say it, therefore their speech is likely to be less controlled. A key-question, in this case, is the so-called "danger of death". However, this technique has not always proven successful. Trudgill, for instance, reports a weak effect in Norwich, suggesting that perhaps the eventful lives of people who live in this community differ from those who live in New York City.

From my personal experience, the "danger of death" question was successful among old participants who remembered, with tears in their eyes, the difficult times they went through during World War II when some areas of East Anglia were bombed by Germans. This question evoked different reactions in the middle generation, who would usually remember the loss of their loved ones (rather than fearing for their own lives) and how they were coping with this traumatic time. This technique, however, was found unsuccessful among young speakers from the three communities, perhaps for the same reasons suggested by Trudgill. Some researchers when faced with this difficulty would hit upon a topic that will engage the speakers in a similar way, such as asking the informants to tell ghost stories (Herman, 1999). Instead of using this strategy with young participants, I replaced the unsuccessful 'danger of death' question and the

'ghost' story with the question 'Which was the worst day of your life?', as some of them might not be familiar with ghost stories, but it is likely that all of them have had a worst day that might have marked their lives. Some of them talked about the divorce of their parents and how difficult it was to be raised up by a stepmother; others talked about particular memories from their childhood (e.g. how they were bullied at school), etc.

It was not extremely difficult to make the informants feel at ease and to let them speak - perhaps my friendly and warm personality played a paramount role. I always respected their privacy and adapted to local customs. Some elderly people shared with me personal memories before the famous "danger of death" or "the worst day of your life" questions were asked; some welcomed me in their houses, some offered to pick me up at the train station in both Ipswich and Norwich to drive me to their places, others showed me photographs and paintings. I have become friends with several others and periodically we meet to attend social events. Usually, recording sessions were scheduled in advance, but I did not attempt to record the informants on every visit, as mentioned above, although I always took recording equipment along[6]. Before turning to the use of instrumental techniques employed for data analysis, let us take a brief step back to selectively review early field methods.

2.5. Early field techniques

Traditional dialectologists had no recording equipment to preserve the informants' speech for later analysis, until the advent of the tape-recorder in 1960s, and field methods were restricted to a small portion of population such as non-mobile older rural

[6] The interviews were conducted by using a PMD661MKII recorder, and recordings were made in .wav files.

males (NORMs) as called by Chambers and Trudgill (1998). In this section, I will selectively review early techniques adopted in three main studies, namely *On Early English Pronunciation, The English Dialect Grammar* and *The Survey of English Dialects.*

On Early English Pronunciation is a noteworthy English survey carried out by Ellis (1889) throughout the 19th century. In this corpus of British, Welsh, Irish and Scottish dialects, a three-part methodology was employed resulting in: *Comparative Specimen*, which consists of a fifty line reading passage with the purpose to obtain "dialect renderings" of daily words; *Dialect Test*, aimed at the identification of vowel sounds as well as features of speech through a further short reading passage; whilst the *Classified Word List* technique involved a large-scale of tokens, the purpose of which was to elicit phonetic-phonological features of the words listed.

The English Dialect Grammar conducted by Wright (1905), sets out the most striking features of all British dialects, classified following Ellis' (1889) suggestions, as mentioned above. In order to carry out his research, he composed a 2,431-word list, including both the literary language and the spoken dialect. Two main procedures were used to arrange the grammar: the first involved lists concerning Old English phonemes, the second concerned variants grouped in relation to individual tokens.

*The Survey of English Dialect*s, conducted under the direction of Orton between 1950s and 1960s at the University of Leeds, is considered a striking archive. The survey includes 313 localities from the Isle of Man, Wales and England[7] and is composed of a three-part elicitation method: (a) the use of *questionnaires* consisted of more than 1000 words intended to elicit phonological, lexical, morphological and syntactical

[7] London and West Yorkshire which, conversely, were included in *The Atlas of English Dialects* (Upton & Widdowson, 1999).

traits; (b) *diagrams and pictures* were used to facilitate the respondents' identification of objects concerning local information; whilst, (c) *spontaneous speech* entailed the informants' opinions, occupational details, the farm, social activities, etc.

An accurate insight into language variation entails including young speakers, women and those living in urban areas; in addition, a detailed investigation of complex speech communities requires quantitative analytical methods to enhance a thorough description of linguistic variation.

2.6. Data analysis instruments

With technological advancements sociolinguists have turned to various quantitative methods which saw the employment of statistics in data analysis. The use of quantitative analysis allows sociolinguists to make generalisations, going beyond single cases with the attempt to develop general rules or patterns. Fasold (1972: 33), for instance, adopted the chi-square test not only to provide a correlation between linguistics and social factors, but also to establish the role of variability within the linguistic analysis. Therefore, he proposed a distinction between *"*truly random variability" and "conditioned variability."

The introduction of more rigorous statistical processes such as the Cedergren-Sankoff Varbrul program, where databases grouped speakers all together rather than analysing them as individuals, had a great impact on early sociolinguistic studies. Guy (1980) suggested to find out whether the variation within the speech community is due to diversity within the group or whether it is present with the same structure in each individual, treating speaker as random effect. This means that it is modelled as a random variable with a mean of zero and unknown variance (Baayen, 2008), allowing

the intercept term to vary across subjects (Barr et al., 2014). This way we can observe which individuals contribute most or least strongly to the variation under discussion.

The succeeding analysis of variance, well-known as ANOVA, was inadequate to handle variationist analysis due to the impossibility to deal with a large number of potential combinations (independent variable and categories) and due to the inapplicable algorithm calculation which typically entails a homogeneous number of tokens per cell (Bayley, 2013).

The program extensively used and designed for linguistic variation is known as Varbrul (Cedergren and Sankoff 1974; Sankoff 1988), an early realisation of binary logistic regression. The latter is a validated theory which allows linguists to model, statistically, "the effect of one or several predictors on a binary response variable" (Speelman, 2014: 487). This methodological instrument enabled researchers to amend hypotheses and re-examine the data. Multivariate analysis was then conducted by Goldvarb 2.0 (Rand & Sankoff, 1990) and Goldvarb X (Sankoff, Tagliamonte and Smith 2005), also known as the variable rule program and an extremely productive tool until a few years ago.

Rbrul, introduced by Johnson (2009), is one of the current tools which provides a wide statistical software package, including the open-source program R to examine both individual and by-group behaviour. In designing the Rbrul program, Johnson (2009) set some crucial goals, such as maintaining multiple logistic regression as well as cross-tabulations like Goldvarb, but also endowing this software with specific functions which were absent in the Goldvarb package. Among these new functions there is the support for continuous predictors (independent variables), for continuous responses (dependent variable) and mixed-effects models supplied with random effects. This way we can observe which individuals contribute most or least strongly

to the variation under discussion. It provides the outcome of effects in log-odds as well as factor weights supported by R-squared and can tackle knock-outs[8]. Unlike some precursory statistical processes, in Rbrul, the number of factor groups is unlimited. Since this tool is more user-friendly than R, Rbrul has been employed in this research for an attentive data analysis and to account for the variation it describes. Data has been subject to mixed-effects modelling, including speaker and word as random effects.

Rbrul does not report the significance of differences between levels in a factor group as p-values refer to the whole factor group. This study follows previous work in how factor weights are represented (e.g. Tagliamonte & Temple, 2005).

The comparison of different nested models was carried out with the log-likelihood ratio test, which performs significant tests with mixed models by comparing the likelihood of one model to the likelihood of another model (Winter, 2020). This is also known as 'deviance tests.' The Akaike Information Criterion (AIC), which provides a means of model selection, was employed to compare non-nested models.

2.7. Dependent variables

The importance of statistical modelling moves beyond some basic points, such as the description of significance tests, and "involves a concept of language use in which a linguistic variable is seen as the output of a system that is influenced by a number of distinct influences, both social and linguistic" (Guy, 2014: 209). This output, also known as the dependent variable, is an essential unit in statistical modelling. A dependent variable can be found at grammatical (syntax, semantics, morphology), phonological and/or pragmatic level (Tagliamonte, 2006). The two dependent variables of this survey are (t,d) deletion and (t) glottaling which, throughout this work, will be

[8] Knock-outs refer to categorical distribution of tokens: zero or 100%.

both referred to as phonological variables - an umbrella term commonly adopted in most studies (Foulkes, 2006) to include the subtle difference highlighted by Hudson (1996) between phonetic and phonological variables. Phonetic variables, under Hudson's (1996: 170) terminology, are those in which "the same phonological pattern has different phonetic realisations", such as the articulation of the phoneme /t/ with [t], [ʔ], and other forms of variation like taps. Phonological variables, are those in which "the same lexical item has alternative phonological structures", such as /h/ dropping in the lexical items *house* and *happy*.

Data for both variables was coded auditorily, as "it is not always possible or practical to undertake acoustic analysis of large bodies of data" (Docherty et al., 1997: 280).

2.7.1. (t,d) Deletion

The first phonological variable examined in this survey is (t,d) deletion - the alternation between [t,d] and Ø – also known as coronal stop deletion (CSD). The type of logistic regression analysis carried out is binary: deletion vs. [t,d]. Even though it is common practice to code tokens realised with glottal stops or glottalisation in the retained category, along with [t,d], in the present study glottal realisations of word-final /t/ were excluded from the (t,d) dataset as (t) glottaling holds social meaning in British English and thus I believe is a different phenomenon[9] (see Chapter 4 for additional excluded cases). A total number of 4,879 tokens was coded into an excel spreadsheet, constrained by linguistic and social factors.

To contribute to the variability of (t,d), the present survey aims at exploring more closely those predictors which suggest that there is a universal constraint on this

[9] For a similar view, see Amos et al. (2020).

variable and which are in line with universal phonetic and phonological properties of segments (e.g. the following phonological environment). A detailed discussion on this respect will be provided in Chapter 4.

2.7.2. (t) Glottaling

In British English, (t) is governed by two closely related processes: T-glottaling, the replacement of /t/ with the glottal stop [ʔ], as in *butter* [bʌʔə]; and glottal reinforcement (often called 'T-glottalisation', 'Pre-glottalisation', 'Post-glottalisation'), as in *mattress* [mæʔtrəs]. In this analysis, (t)-glottaling, the few cases of glottal reinforcement of /t/ with [tʔ] (n = 8) or [ʔt] (n = 24), and the few cases where a period of creaky voice occurred (n = 4) are all coded the same. As Straw & Patrick (2007: 388) note, the term glottalization is vaguely used in the literature "to refer to one or more such elements (e.g. now including complete stops, now excluding them), especially when generalising across studies". Docherty & Foulkes (1999: 54) propose the label 'glottal(ised)' variants as it "covers two distinct [acoustic] types." [10]

These alternations, throughout this work, will be referred to as glottal variants, due to the high number of tokens with alternating production of [t] and [ʔ] in the dataset, compared to the relatively low number of other types of glottal variation. 4,923 tokens were collected; in 3,051 cases (62%) /t/ occurred in word-final position (e.g. *that*), while in 1,872 cases /t/ was found in word-medial context (e.g. *nightmare*).[11] Each realisation of (t) was coded into an Excel spreadsheet[12], along with internal and external independent variables. The type of logistic regression analysis conducted is

[10] Further terminological details will be provided in Chapter 5.
[11] The total number of tokens does not include cases realised with the alveolar tap [ɾ], as they were excluded prior coding.
[12] For the excluded cases see Chapter 6.

binary: glottal variants vs. /t/. To potentially contribute to the variability of (t), one of the main purposes of this study is to also explore (t) glottaling in environments which received little attention in the literature (e.g. the preceding phonetic segment) and in linguistic contexts where (t) glottaling was considered to be blocked (e.g. after a non-resonant consonant, as in *project*). A critical and more detailed explanation as to why these environments have not been excluded from the analysis will be discussed in Chapter 5 and Chapter 6.

2.8. Independent variables

The linguistic factor groups included in this survey are the same for both variables, with the exception of voicing agreement (homovoiced vs. heterovoiced) which was only coded for (t,d). The remaining linguistic predictors are listed as follows: preceding and following phonetic environment, and syllable stress; whereas the external predictors include lexical frequency,[13] socio-economic class, age, sex, and style. Both preceding and following environments were coded on the phonetic surface. Following /h/, for instance, was coded either as [h] when the voiceless glottal fricative was consonantal, or as a vowel when /h/ was dropped. Each case of /h/ dropping was coded as (h)-V_{type}, implying that the following phonetic segment was realised with a particular vowel type in those tokens where /h/ was underlyingly present. The same procedure of coding on the phonetic surface was applied to the so-called 'David variable' – the alternation between the 'standard' form [ɪ] and the 'non-standard' [ə], as in *wanted*

[13] Location was initially included in the model to control for variation in geographical space yet, as expected, this predictor turned out not to be statistically significant, therefore it was subsequently excluded from the analysis. However, statistical details related to this factor group will be presented in Appendix I and Appendix II along with other non-significant predictors.

[wɑnʔəd] rather than [wɑnʔɨd][14]. Historically rhotic tokens /-rt/, /-rd/ were excluded prior to coding in both (t,d) and (t) datasets. In the (t,d) dataset, /-lt/ /-ld/ sequences were only coded when /l/ was phonetically consonantal. In the (t) dataset, /l/ was coded as a vowel when the lateral-approximant was vocalised, whereas when /l/ had consonantal features it was coded as consonant.[15]

Following pause is a delicate context to inspect, especially when examining the intersection between /t/ deletion and /t/ glottaling in the C(C)t_P$_{ause}$ context (e.g. *good poi<u>nt</u>*.). Tanner et al. (2017: 8) point out, that a following pause is commonly treated as an environment in sociolinguistic literature on CSD, similar to that of following consonant or following vowel. However, they state that "beyond a certain pause length, it is very unlikely that an upcoming word would be planned, and in this limiting case *pause*, or rather, the null environment, is indeed a separate type of context." [16]

The criterion I adopted to measure pause is largely based on the pause duration following Fors (2015). Along the line of Fors (2015), in the *Production and Perception of Pauses in Speech*, a typical pause lasts only about a quarter to half a second. Since the presence of a glottal indicates some reflex in the signal (creaky vocal fold pulses or a spike in voicing offset), in this study, a pause is considered to begin after the voicing bar either ceases abruptly or fades out. Based on this criterion, an interruption of the voicing bar early in the pause indicates a glottal variant, whereas no evidence of /t/ or glottal gesture early in the pause implies /t/ deletion. Figure 2.8.1 illustrates an example

[14] This characteristic feature of East Anglian English is found to apply in unstressed, closed syllables (Trudgill, 1986) and in unstressed open syllables (Potter, 2018).

[15] L-vocalisation is considered a distinctive feature of London English (Wells, 1982), and it is also present in the North, especially in Yorkshire (Ihalainen,1994). However, some areas of East Anglia inhibit /l/ vocalisation (Johnson & Britain, 2007). It is argued that vocalisation of /l/ is more likely to occur in dialects which have a clear distinction of 'clear' and 'dark' /l/ and, in Northern East Anglian dialects, the use of /l/ was found to be clear until the 20th century (Johnson & Britain, 2007). Indeed, common pronunciations of *hill* as [hɪl] are typical of rural East Norfolk (Trudgill, 1999).

[16] Tanner et al. (2017) use pause length as a proxy for prosodic boundaries in their CSD analysis, showing that "longer pauses gradiently decrease deletion."

of /t/ deletion in the word *amusement* realised by an eighty-two year-old man from Colchester: the duration of the pause is nearly half a second and both auditory analysis and spectrogram reveal neither coronal nor glottal gesture evidence early in the pause.

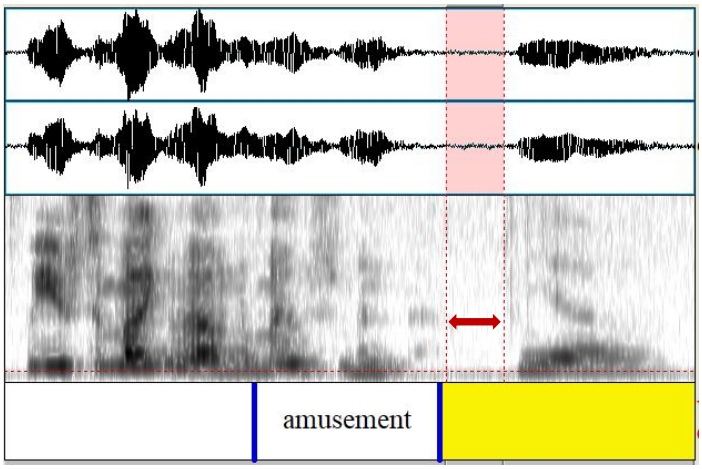


Figure 2.8.1 /t/ deletion after the alveolar /n/ and before a following pause.

Filled pauses (FPs), or non-silent hesitation phenomena, such as *uh, um,* and *em* are excluded from the analysis.[17] Praat was also employed to detect /t/ deletion and /t/ glottaling in some other critical cases, as shown in figure 2.8.2 and figure 2.8.3. Figure 2.8.2 illustrates an example of /t/ deletion in the word sequence *went in* produced by a working-class middle-aged man from Norwich. The spectrogram displays visible vocal folds vibrations in the realization of /n/ which precedes the underlying oral stop /t/ and it is immediately followed by the next sound. Hence, the absence of the voiceless coronal /t/ is represented by the transition from the alveolar /n/ to the following phonetic segment – represented, in this case, by the high vowel /ɪ/.

[17] For a detailed account on filled pauses see Fruehwald (2016).

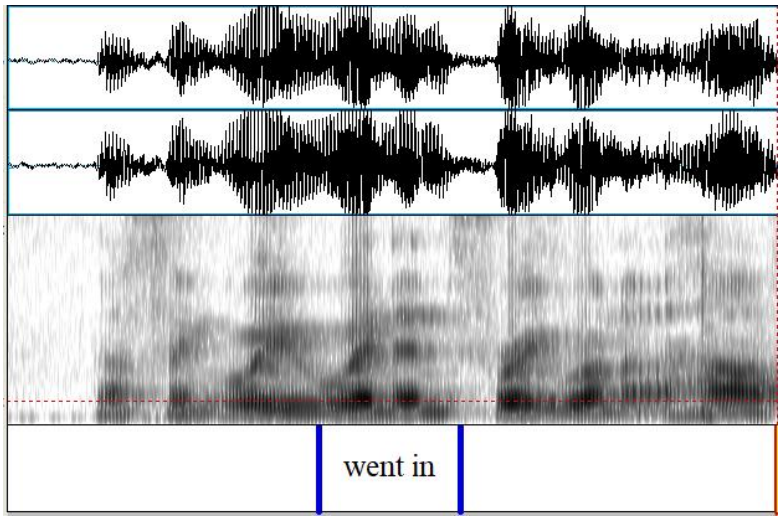


Figure 2.8.2 Example of /t/ deletion: transition to the following phonetic segment.

Figure 2.8.3 illustrates an example of (t) glottaling in the word sequences *didn't allow* realized by a working class middle-aged man from Norwich. The spectrogram shows vocal fold vibration of the segment /n/ which is followed by an audible glottal stop. The latter is not defined for voice, but it allows some vibration whether the glottal constriction is weak; whereas, a total glottal occlusion would obstruct all airflow. The underlying representation of /t/ which, in the *didn't allow it* sequence, is articulated with the glottal stop is then followed by a vowel sound.

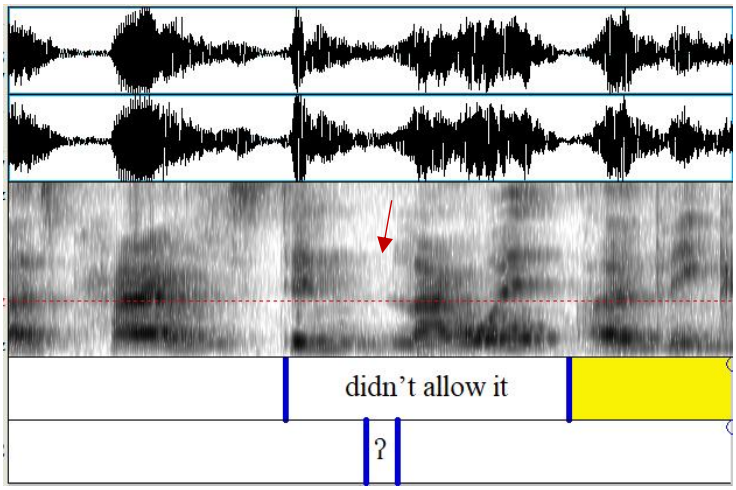


Figure 2.8.3 Example of /t/ glottaling followed by a vowel.

Syllable stress is a further predictor taken into account in the analysis of both variables, and it was coded as a binary factor: stressed syllable or primary stress (e.g. *left; sit*) vs. unstressed syllable or non-primary stress (e.g. *happened; community*).[18]

The Zipf-scaled SUBTLEX-UK corpus (van Heuven et al., 2014) was adopted to control for word-frequency as it improved the measure of lexical effects in psychology (Brysbaert & New 2009) and it is also becoming a popular tool in linguistics (Tamminga 2016; Baranowski & Turton, 2020). The 201.3 million words included in this corpus are obtained by film and TV subtitles from BBC broadcasts.

The standard measure which researchers typically adopt to account for word frequency is based on the *frequency per million words* (fpmw), a measure which is usually independent of the corpus size. In corpora made of only 1 million words, a measure of 1 seems to be the lowest value; however, van Heuven et al. (2014) point out that more than half of a word frequency list contains items whose frequency value are lower than 1 *pmw*. For an easier understanding of the word-frequency effect, they suggest employing a typical Likert rating scale, from 1 to 7, without using negative values.

In addition, van Heuven et al. (2014) uphold that "the middle of the scale should separate the low-frequency words from the high frequency words." Values 1-3, in the SUBTLEX-UK corpus, represent low frequency words, whereas values 4 -7 represent high frequency ones. A comparison between Zipf values employed in the SUBTLEX-UK corpus and *fpmw* is provided in the table to follow, where words whose *fpmw* is .1 get a value of 2.

[18] Note that stress has been included in few studies which have examined the variability of (t) glottaling (e.g. Tollfree 1999; Roberts 2006; Eddington and Taylor 2009; Barrera 2015).

Zipf values	*Fpmw*	Examples
1	.01	antifugal, bioengenieering, farsighted, harelip, proofread
2	.1	airstream, doorkeeper, neckwear, outsized, sunshade
3	1	beanstalk, cornerstone, dumpling, insatiable, perpetrator
4	10	dirt, fantasy, muffin, offensive, transition, widespread
5	100	basically, bedroom, drive, issues, period, spot, worse
6	1,000	day, great, other, should, something, work, years
7	10,000	and, for, have, I on, the, this, that, you

Table 2.8.1 A comparison between Zipf values and fpmw, adapted from SUBTLEX-UK website (van Heuven et al., 2014).

The socio-economic class is also employed for multivariate explanatory analysis in this survey, yet it is not the main focus of examination. As Patrick (1999: 82) highlights:

> "The variationist paradigm retains its structuralist roots to the extent that it seeks first to account for variation through system-internal, linguistic explanations as far as possible, before turning to system-external elements such as the social characteristics of speakers."

This study goes in this direction without downplaying the considerable role of social factors. As outlined in the previous Chapter, the use of this factor as an indicator has been a debated issue over the years in the social sciences. For the stratification of social class, I adopted the European Socio-Economic Classification (ESeC) model (Rose et al., 2010), which is mainly based on economic and division of labour criteria rather than cultural ones, and household and family are used as a unit rather than the individual. The 10 classes proposed by Rose et al. (2010) can be collapsed into six, five, and three-level models, as shown in the table to follow:

ESeC class	10 version class	6 class version	5 class version	3 class version
Higher salariat	1			
Lower salariat	2	1+2	1+2	1+2
Higher white collar	3	3+6	3+6	
Petit bourgeois	4			
Small farmers	5	4+5	4+5	
Higher grade blue collar	6	3+6	3+6	3+4+5+6
Lower white collar	7	7	7	
Skilled manual	8	8		
Semi-/unskilled	9	9	8+9	7+8+9
Unemployed	(10)	(10)	(10)	(10)

Table 2.8.2 Collapsing ESeC classes. Adapted from Rose et al. (2010).

The benefit of using this class model in sociolinguistic research is twofold: (1) the transparency by which classes are collapsed to a three-level model allows sociolinguists to employ this schema in small-scale surveys; (2) since this model is merged with the European socio-economic classification this schema could be used as a point of comparison between studies carried out across Europe to control for the effect of this variable.

Since the sample for the present study is stratified by working and middle class, I adopted the three-level version by excluding class 1+2 - the combined group of higher and lower salariat[19]. Hence, the speakers were stratified based on the following classes: 7+8+9 (what I refer to as working class in this study) and 3+4+5+6 (what I refer to as middle class), as illustrated in table 2.8.2. In detail, class 7 includes "non manual workers", such as shop workers, care workers, etc. Class 8 includes "skilled workers" or lower technical occupations, such as plumbers, locomotive drivers, etc. Class 9 encompasses "semi-and non-skilled workers" – a type of work which is paid by the

[19] Lawyers, scientists, higher education teaching professionals, etc. belong to the 1+2 group.

piece or hourly paid. Cleaners, labourers, messengers, etc. are to be found in this category. Class 3 includes "higher grade white-collar (non-manual) workers", such as administrative assistants, jobs which require working alongside managers, etc. Classes 4 and 5 comprise small employers and self-employed, with the latter referring to those who neither buy nor sell labour. Class 4 includes non-professional occupations; while class 5 covers "the self-employed and small employers in agriculture, fisheries and forestry." The informants were assigned to a specific occupational level based on their whole occupational history, not merely on their most recent occupation; while students were classified on the basis of their parents' socioeconomic position.

A further social factor employed in this survey is the age of participants, which is usually taken into account in most variationist studies to control for linguistic change (Schilling, 2013). While (t) glottaling is considered a change in progress, as "the results for older speakers […] seem to reflect the traditional stigma of T-glottalisation, particularly in intervocalic contexts" (Tollfree, 1999: 171), the profile of (t,d) deletion is that of a stable variable in previous research, and the age of participants is usually a low-level constraint. This study is built on an apparent-time methodology, with speakers stratified by three age cohorts: young (18-28), middle (35-50), old (60+). This stratification is mainly etic (by chronological age), but it includes some emic qualities (by cultural life stages) which mirror the British society, such as the entrance of teenagers into adulthood at 18 years old[20].

The informants were also stratified by the binary category of biological sex (males vs. females) following the traditional variationist approach in order to compare results with previous studies. This constraint is not explored in terms of gender as this approach is

[20] See Eckert (1997) who explains that culture plays an important role.

beyond the purposes of this thesis; indeed, the identity of participants is not the principal object of enquiry.[21]

Finally, the variation of (t,d) and (t) is explored in the dimension of style – a pivotal construct in sociolinguistic studies (Eckert & Rickford, 2001). In this survey, style is to be intended as attention paid to speech (Labov, 1972) with attention being "the cognitive mechanism that links social to linguistic factors" (Eckert & Rickford, 2001: 2). In some English varieties, the use of a particular speech style is adopted to convey the high social position of speakers, such as the Speaky-Spoky Jamaican speech style[22] (Patrick, 1997). Foulkes and Docherty (2007) emphasize that the speech is not only modified due to self-consciousness (i.e. using more of standard variants as formality increases), but audience, interpersonal dynamics (e.g. Eckert & Rickford 2001; Eckert 2008), cognitive and interactional factors (Sharma, 2018) play a notable role. Trudgill (1986), in the Norwich study, found variation in his own use of the glottal stop in relation to glottal rates adopted by his interviewees. These approaches, however, are beyond the purposes of this survey. In the present work, stylistic variation will be elicited through sociolinguistic interviews, reading passages and word lists. The latter aims at observing the two phonological variables when tokens are mostly realised in isolation.

[21] It should be highlighted, though, that all my participants identified as males or females, none of them identified themselves otherwise.
[22] This style is stereotypically associated with female speech. See Patrick (1997) for further details.

2.9. Summary

This Chapter has focused on the present sample stratification, on the field techniques employed to enter the three speech communities, and has discussed data analysis instruments. It has also presented a brief description of the two dependent variables, also providing a short discussion on analytical procedure (e.g. coding), and has discussed the independent constraints included in the model.

Chapter 3 - (t,d) DELETION: LITERATURE REVIEW

This Chapter reviews previous studies on (t,d) deletion in both US English dialects - where (t,d) has been a "showcase variable" (Patrick, 1999: 122) - and in British English dialects where little research on this phonological variable has been carried out.

Firstly, I will provide a phonetic description of /t/ and /d/ as well as a description of (t,d) as a sociolinguistic variable, followed by some terminological remarks. Secondly, we will see how this linguistic feature has diachronically developed, and then emphasis will be placed on quantitative and qualitative analysis carried out on (t,d) across English varieties. Since this variable has been widely researched in numerous North American dialects, the literature will be selectively reviewed here.

3.1 Articulatory description of the plosives /t, d/

Phonetically, /t/ is a voiceless alveolar stop, articulated by obstructing airflow in the vocal tract. A feature matrix for /t/ is [-continuant] [-sonorant] [+coronal] [-voiced] (Roca and Johnson, 1999)[1]. Similarly, /d/ is an occlusive whose distinctive features are [-continuant] [-sonorant] [+coronal] [+voiced]. Cruttenden (2001) highlights that the lip position of /t/ and /d/ is highly affected by that of the adjacent segment, particularly that of following vowels or glides (e.g. /w/). Moreover, the alveolar stop is sensitive to the conditioning of the place of articulation of a following consonant. From a sociolinguist standpoint, both /t/ and /d/ are commonly treated as one variable due to their similar behaviour in word-final consonant clusters (for an opposite argument see Amos et al. 2020; Pavlík 2017).

[1] See Chapter 5 for a more detailed account on /t/ phonetically.

3.2 A brief note on terminology

In the (t,d) literature terms employed to refer to the absence of realisation of word-final coronal stops appear to be semantically identical, such as *deletion*, *simplification*, *reduction*, *removal*, *loss* or *absence*. However, the term *deletion* can be problematic in some English varieties such as Standard Jamaican English (SJE) or Jamaican Creole (JC). Terms like *removal* or *loss* imply that "the basilectal speaker has an underlying representation of the *missing* element" (Lacoste, 2012: 69).[2] By way of contrast, in the present study these terms will be used interchangeably as in British English they do not hold such a structural linguistic connotation. Similarly, the terms such as *retention, presence, realisation*, *production* of coronal stops /t/ and /d/ will be used as synonyms throughout this work.

3.3 Description of the (t,d) variable

The sociolinguistic variable referred to as '(t,d) deletion' is deemed to be a form of lenition, which weakens by having a null realisation of apical stops /t/ and /d/ in word-final consonant cluster /Ct/ and /Cd/ or /CCt/ and /CCd/[3], as shown in (1):

(1) a. […] she was jusØ calling her friend […]

b. […] during the *weekenØ* we'll usually go into town […]

c. […] she is *concernØ,* you see? […]

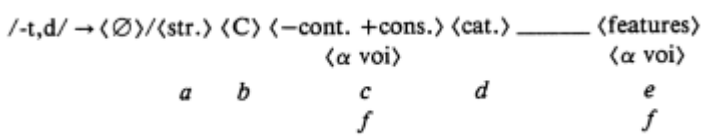
d. […] she *didn'Ø* like the view […]

[2] However, the assumption that Creole is underlyingly simpler in terms of linguistic structure does not hold for the mesolect from a variationist perspective (See Patrick 1999 for further details).

[3] (t,d) deletion differs from the more general final stop deletion rule (see Guy, 1980 p.4). Most of the stops which fall under this rule are mainly /t/s and /d/s, as velars and stops occur in final consonant clusters very rarely; most of the cases as listed by Guy (1980) are: /sp, sk, lp, mp, lk, ŋk,/. Apical stops are the only plosives that can occur in a cluster preceded by many other consonants including stops, hence the above rule is restricted to final /t,d/ deletion. Moreover, Temple (2014) also considers it alongside other word-boundary sequences, including simple-codas, yet this approach is beyond the scope of this PhD.

It is claimed that all English speakers delete /t,d/ at least occasionally, but no one does it categorically. This phonological variable has been widely investigated in many US English dialects and, despite slight differences in constraint ranking, phonetic and morphological constraints were found to be largely uniform. Patrick (1999: 124) claims that some conditioning factors mirror speech community rules, whereas others are shared by many dialects, and others have "a basis in phonetic, functional or phonological universals." The pan-dialectal constraints, as summarised by Labov (1989: 90), show that the rule application below (2) is favoured in:

(2)



a. syllable stress: unstressed > stressed

b. cluster length: CCC > CC

c. by certain preceding phonetic segments, yielding the segmental order:

/s/ > stops > nasals > other fricatives > liquids;

d. by morphological classes, with the order:

n't > monomorphemes > semi-weak verbs > regular past verbs

e. by certain following phonetic segments, yielding the segmental order:

obstruents > liquids > glides > vowels > pause

f. by voicing agreement: homovoiced > heterovoiced.

Although morphological class has been proven to have a robust effect on (t,d), this feature remains a phonological variable as the same surface alteration occurs in distinct morphological contexts[4], yet in the same phonological one (i.e. in word-final consonant cluster). Indeed, the (t.d) variable rule does not apply when the past

[4] In monomorphemes (*mist*), semi weak verbs (*left*), regular past tense verbs (*called*).

tense form has epenthetic schwa (e.g. *wanted*) or when /t,d/ is preceded by a vowel (e.g. *played*).

3.4 Neutral contexts

The above rule (2) summarised by Labov (1989) does not include some neutral contexts in which the production or the absence of /t/ or /d/ cannot be reliably detected. The neutral environments which are usually excluded from previous (t,d) studies concern tokens followed by homorganic tops /t/, /d/ (e.g. *you can'Ø tell*; *I can'Ø drop the key*); occurrences followed by post-alveolar fricatives /tʃ/, /dʒ/ (e.g. *I can't choose*), and interdental fricatives /θ/, /ð/ (e.g. *my husbanØ thinks that*…; *I missØ the train).* Interdental fricatives are considered neutral contexts as in British English, for instance, they may be realised as their corresponding stops (Bayley, 1994). Cases of exclusion include the approximant /r/ in the preceding environment as, in some English dialects (e.g. many British English dialects; Chicano English), /r/ is not consonantal, as in *card* [kɑːd]. In a similar vein, tokens not considered are those where preceding /l/ occurs in a cluster, yet /l/ has vocalic features (i.e. /l/ vocalisation). The features assigned to [l] and [r] in phonological theory are [+cons; + voc] (Chomsky & Halle, 1968), yet, in the case of non-rhotic accents or vocalised /l/, the lateral [l] and the approximant [r] have [-cons; +vocalic] features[5]. In some American dialects, clusters of alveolar nasal plus final stop preceded by unstressed vowels are also excluded due to the intersection with the nasal flap formation rule (Labov, 1989), hence it is onerous to establish whether the coronal stop is realised

[5] The distinctive features of [r] have been a debated issue over the years. Chomsky & Halle (1968: 302), for instance, define [r] as consonantal due to its *radical obstruction*, "even if it does not make a complete contact with the roof of the mouth". However, in their discussion the feature of [+cons] is not assigned to glides [y] and [w]. In this respect, Fasold (1972: 89) questions that the obstruction of English [r] is more "radical" than that of glides.

or reduced. High frequency lexical items are also excluded, such as *and*, *just* (e.g. Patrick 1999). Temple (2017) argues that there are further consonants which could be treated as neutralising contexts, yet which seem never to be mentioned. The most remarkable is [n], realised with apical occlusion at the alveolar ridge. She claims that when nasality occurs within a token, a following nasal may be distinguished from coronal stops, and other stops, especially when the latter are voiceless. However, the nasal category is non-segmental, that is it is sporadically co-temporal with other features of the segment. In (3), for instance, the sibilant [s] seems to be followed by aspiration plus a devoiced nasal which is clearly audible. However, Temple (2017) argues that it is not easy to establish whether the aspiration is a reflex /t/ followed by nasal assimilation or whether the coronal stop is deleted and the nasal is devoiced.

(3) *They are best not.*

She also suggests inspecting carefully masking effects. The term "masking" (p. 135) is used to designate an incomplete articulatory gesture which is hidden by the articulation

of neighbouring [+cons] features. In the event of no release, the absence or presence of /t,d/ might be questionable as she illustrates in (3):

(4) Having this lego kept me occupied for years.

In the above example, despite lack of evidence of coronal [t] in the spectrogram and auditorily, Temple (2017: 136) claims that it is impossible to assert a categorical deletion as

> "the relatively short duration of the closure in *kept* compared to the /p/ of *occupied* is ascribable to a rapid deceleration of speech rate and cannot necessarily be taken as an indication of /t/ deletion".

A further aspect of masking effects brought to attention is contributed by assimilation, especially with nasals which often tend to assimilate to the place of articulation of a following consonant, as in *different plane*, *sound box*, *combined court* (Temple, 2017). While discussing the masking effects for (t,d), she states that the glottal stop is a potential pronunciation of (t,d), even if no masked alveolar gesture can be detected. Along this line, Temple (2017: 145) suggests that: "it would be necessary to carry out detailed phonetic comparisons of a number of tokens with potential sequences of glottals to establish whether there is, for example, a pattern of variation […]." This suggestion is mostly related to the length of the glottal stop as in *worked*, where [ʔ] and [t^h] may be considered sequential reflexes of /k/, versus a shorter glottal reflex found in *work*, for instance. The measurement of glottal length, however, is beyond the purpose of this survey. In terms of phonetic gradience, Purse and Turk (2016), argue that categorical[6] deletion is not frequent in their Electro-Magnetic Articulography (EMA) data of Scottish and Southern British English speakers.

Having reviewed the features of /t,d/, described (t,d) as a sociolinguistic variable and provided an overview of the neutral contexts, let us now supply some terminological remarks, before turning the attention to the diachronic development of this variable.

3.5 (t,d) in Sociolinguistic theory

It is common knowledge in the sociolinguistic field that the theoretical construct of *sociolinguistic variable* refers to variants which are traditionally defined as different ways of saying the same thing. 'Variant' refers to the phonetic realisation of a phoneme,

[6] The term categorical in this context means articulatory categorical, which differs from the variationist use of the term (e.g. 100% of application) (Temple, 2014).

while the more abstract representation of the source of variation is known as *variable.* (t,d) deletion is one of the oldest sociolinguistic variables investigated in English dialects on variationist grounds, and it is a classic example of a stable marker[7] in English dialects. The beginning of stable variability resembles that of a change in progress, yet the two or (more) surface forms may co-exist for centuries, with no evidence that one variant is pushing out its counterpart (i.e. the new item does not replace the old variant in underlying representation). The relationship between stable variables and social factors mainly concerns sex and social class, as outlined in Chapter 1. The age of participant, however, typically plays a marginal role in stable variables as there is no evidence from generational change that newer forms may become lexicalised. Reynolds (1994), with respect to (t,d), claims that the influence of solely social factors does not explain how the change originally moved.

3.6 A brief diachronic development of (t,d)

When reconstructing a point of origin of a variable, the question to be posed is whether all variable rules spring from diachronically categorical ones (Romaine, 1984). According to Labov, all rules initiate as variable ones and, over time, they gradually spread according to the environments until they reach the final stage of completion (i.e. to become entirely regular in its application)[8]. Bailey (cited in Romaine 1984) claims that the change from categorical rule to variable rule is unnatural and argues that the historical process of a rule can be predicted by the weight orderings of environments (i.e. slower vs. faster). His prediction is that heavier environments are subject to a faster application of the rule compared to lighter environments. This kind of change is usually

[7]For the definition of *marker*, in sociolinguistic theory, see section 5.2.
[8] Reaching completion most of the time may never occur as the two variants may compete for many generations.

faster and earlier while, based on Bailey's Principle 20, little quantitative evidence means that the application is slower and later. However, Romaine (1984: 247) argues that "there are cases where a temporally earlier rule or environment can produce a lower quantity of output than a later one, and in which newer rules may have typically larger outputs than older ones." (t,d) is a well-documented process which has been a common practice since at least the late 14th century (Wyld, 1927). Evidence from earlier documentation shows that bimorphemic clusters spring from the suffixation of /t,d/ to some verb stems, a phenomenon which is also known as Germanic dental preterite[9]. Romaine (1984) shows that in the 16th century, preterite and past participle forms end in *-it*, with only few items ending in a cluster as *promist*. Verbs which are usually referred to as "semi-weak" in the (t,d) literature (i.e. stem vowel change and suffix past-marking) can be found with /t/ absence in Middle English, from the beginning of the period. An early example (e.g. *slep*) arose from the *Peterborough Chronicle,* as reported in Romaine (1984):

He lai an slep in scip
Crist and his halenchen slep.

Wright (1905) notes that /*kept/* is commonly realised as /*kep/* in the Midlands as well as in northern dialects, yet this is not due to /t/ loss, while the loss of apical stops /t/ and /d/ after a preceding /n/ as in *blyn* 'blind' in also found in the Modern period (Wyld, 1927). Wyld also provides numerous examples of /t,d/ absence word-medially followed by consonants in the 15th-18th centuries, such as *freenly* 'friendly', *hansome* 'handsome', *Chrismass* 'Christmas'[10].

[9] See Prokosch (1939) for further details and for debated issues.
[10] Similarly, Cruttenden (1994) reports the loss of apical stops in medial position in clusters of three consonants in Present-day English, such as *exactly, handsome, windmill, handbag, friendship, landlord, restless, landscape,* etc.

However, as Reynolds (1994) notes, all of the examples provided by Wyld refer to monomophmes or compounds. During the 14th century, /t,d/ did not occur in final consonant clusters, except for a few irregular Old English (OE) verbs, such as *geseald* 'sold', *geteald* 'told', as well as *gelegd* 'laid'. Indeed, past-marking in both OE and Middle English (ME) was /-ədə/ (e.g. worshipede) (Luick, 1921). The schwa started to disappear in late 15th century, at the end of the ME period and this linguistic change was fully completed after three centuries.

Milroy (2007) reports that /d/ absence after [n] appears around 1700. Its reduction is visible in hypercorrect spelling (e.g. *gownd* for 'gown') as well as in hypercorrections which survived over years, such as *sound* from ME *soun* < Fr *soun*. Romaine (1984: 242), however, argues that there is "no reason to reconstruct a period in the history of English in which final t/d was uniformly present in mono- and bimorphemic clusters." She suggests that there is no reason for doing so due to lack of evidence of a prior state of categoricality.

3.7 Empirical findings from North American studies

(t,d) deletion as a sociolinguistic variable has raised interest among variationists since the 1960s. Empirical findings show that it is markedly conditioned by the following phonological context and the grammatical status of the word-final apical stop, while the preceding phonological environment has been considered a "tertiary constraint" (Guy, 1980: 20). This variable has been initially explored through quantitative analysis and examined under the effect of external constraints in African American Vernacular English (AAVE) in New York City (Labov & Cohen 1967; Labov et al.1968).

The variability of (t,d) has been then investigated in Detroit (Wolfram, 1969); in Washington (Fasold, 1972); in New York (Guy, 1980), Philadelphia (Guy 1980;

Tamminga 2016); and Buckeye English (Ohio) (Tamminga & Freuhwald, 2013); also in first language acquisition by children (Labov 1989; Roberts 1994; Lacoste 2012) and second language acquisition (Bayley 1991, 1994); in English varieties influenced by Spanish, such as Chicano English in Los Angeles (Santa Ana, 1991), Tejano English in San Antonio (Bayley, 1994); in creole varieties, such as mesolectal Jamaican Creole in Kingston (Patrick, 1999), and Standard Jamaican Creole (Lacoste, 2012).

3.7.1 (t,d) in AAVE

Earlier studies on (t,d) were conducted in non-standard "Black English".

Labov and Cohen, (1967) interviewed 100 random speakers in the main area of South Central Harlem, and investigated (t,d) deletion along with other variables, such as (-ing), /r/, -s absence of copula, etc. With respect to (t,d), only two categories were distinguished for the following phonological environment: following vowel vs. non-following vowel, with the latter including (liquids, pauses and maybe glides). A binary distinction also concerns the grammatical status of /t, d/, resulting in mono-morphemic vs. bi-morphemic items. Results show that the effect of the morphological class surfaced as a remarkable constraint, with regular past tense verbs (e.g. *passed*) undergoing simplification in all age groups, yet the rates of deletion increased in monomorphemes. Working-class speakers exhibited a stylistic shift in monomorphemes in the non-following vowel and following vowel environments; whilst, in the speech of middle-class members the cluster reduction increased when /t,d/ was followed by consonants.

To provide a deeper insight into non-standard English of Negro and Puerto Rican speakers, Labov et al. (1968) examined (t,d) in 3,359 tokens collected in Central Harlem. The regularity of (t,d) absence, once again, was found in each group of

respondents, regardless of the age level or the neighbourhood they lived in. This study has shown that some speakers had categorical deletion of /t/ when the coronal stop followed the voiceless sibilant /s/ (i.e. *–st*). Also, this work has revealed that the simplification of apical stops may be influenced by the presence or absence of voicing in the consonant cluster, and that (t,d) is less likely to undergo deletion if the first member of the cluster is a sonorant. With respect to the grammatical category, 74% of past-marking presence surfaced in regular verbs; whilst, unmarked cases are believed to be entirely conditioned by phonological factors. So far, semi-weak verbs are not included. It is with Labov et al. (1980) that we have a three-way distinction between monomorphemic, ambiguous (or semi-weak), and bimorphemic forms.

Wolfram's (1969) study also focused on the cluster simplification in AAVE in Detroit by taking into account the ethnicity, social class, age and gender of the participants. He collected his data among 12 lower working-class speakers, 12 upper middle-class speakers and, for comparison, 12 white upper middle-class speakers. The number of tokens is unknown, as Patrick (1999: 162) also reports in a detailed comparative table between (t,d) studies. In Wolfram's study, the following phonetic environment seemed to have a notable impact on the cluster reduction, despite the lack of a hierarchical ordering. It has to be noted, though, that following pause was treated as vowels. Working-class speakers exhibit the highest deletion rate in monomorphemic tokens followed by consonants (97%), while /t,d/ in bi-morphemic words followed by vowels, was less likely to be deleted among middle-class members. Wolfram's (1972) data did not provide a clear explanation on how much the age of the informants may affect (t,d) deletion. He claims that the reduction of the second item in the consonant

cluster occurs if: (1) the second member is a stop; (2) the two items share the same voicing specification[11].

Along the line of Wolfram (1969), Fasold (1972) divided the following segment into consonants vs. non-consonants showing an analogous outcome, that is following consonants are the most preferred environment for (t,d) reduction. Initially, Fasold (1972) distinguished following pause from following consonants, yet due to the nearly identical result between the two categories, they were collapsed. His corpus was collected in Washington DC to investigate tense marking in Black English. 47 working-class informants of all ages were interviewed through one-to-one interviews, reading passages and word games, and 883 tokens were analysed. He treated separately the simplification of [d] after vowels, whilst he did not isolate the [st] cluster as Labov did. With the use of chi-square tests, he aimed to provide a correlation between linguistic and social factors, and to also establish the role of variability within the linguistic analysis, distinguishing truly random variability from conditioned variability. His findings show that deletion occurred the most when /t,d/ was followed by spirants and stops, and that preceding /s/ (e.g. *cast*) increased deletion more than other voiceless spirants. Voicing, however, is not a significant constraint for the Washington data. More deletion occurred in bi-morphemic tokens followed by consonants (76%) than in bi-morphemic ones followed by vowels (29%). Irregular verbs (i.e. *left*) were treated separately, showing a 98% rate of past-marking. He also noticed that the voiced alveolar [d] is devoiced in verbs, such as *send-sent.* Similar findings are reported for Jamaican Creole (Patrick, 1999), where the devoicing processes is extended to five verbs (see section 3.4.4 for more details).

[11] [ld] clusters were excluded in the Detroit study (Wolfram, 1969).

Patrick et al. (1996), in the U.S. South, investigated the behaviour of (t,d) in 11 ex-slave elders, who exhibit analogous percentages of (t,d) absence in monomorphemes followed by consonants (56%) and monomorphemes followed by vowels (55%). Lower reduction rates are reported for bi-morphemic words: 44% for those followed by consonants, and 26% for those followed by vowels. The increasing of deletion was associated to the increasing of sonority, with preceding /l/ being the most conditioning segment.

3.7.2 (t,d) in US English dialects

Neu (1980) and Guy (1980) carried on with the distinction between monomorphemes (i.e. *mist*), regular verbs (i.e. *called*) and ambiguous verbs (or semi-weak verbs, e.g. *told*). The latter refers to those verbs which undergo a stem vowel change as well as past-tense affixation. Neu's (1980) findings did not show a marked deletion difference in ambiguous verbs. She examined 2,217 tokens in the speech of 15 white informants from the U.S. North[12], and employed chi-square tests to validate the ranking constraint. Her study shows that the lexical item *and* turned out to be nearly categorical, indeed, when it was included in the monomorpheme category, deletion rates increased sharply. She explored (t,d) in both following manner and place of articulation. The latter, however, was not marked as a significant constraint. Her findings report a high-level deletion in following consonants, with no consonant class differing significantly from the others. With respect to the preceding phonetic segment, results were reported in

[12]The participants were from: California (n = 5), Ohio (n = 2), Michigan (n = 2) Baltimore (n = 2), Nebraska (n = 1), Missouri (n = 1), Massachussetts (n = 1) and New York City (n = 1). As for the age of participants, 5 speakers were aged between 19 and 23, 8 speakers aged between 27 and 35, 2 speakers aged between 48 and 53

two parts, as they differ for males and females. Males exhibit the following ranking: sibilant > nasal [excluding *and*] > stops; by contrast females' hierarchy shows partially reversed result with preceding stops leading the ranking: stops > sibilant > nasal [excluding *and*].

Guy (1980) conducted his (t,d) study in the speech communities of Philadelphia (19 speakers) and New York (4 speakers). In this study, the consonant category of the following phonological environment is broken down into: consonants, liquids, glides, and vowels, while for the preceding phonological segment a five-way coding was employed: sibilants, non-sibilant fricatives, nasals, stops, and laterals[13]. Results show that a following pause has the same effect as following consonants in promoting deletion amongst New Yorkers, whilst for the Philadelphians a following pauses behaves like a vowel in disfavouring (t,d) absence. The preceding segment is considered a relatively weak constraint, with more reduction when /t,d/ follows /s/, and more coronal stop retention when preceded by the lateral /l/. With respect to the morphological class, deletion occurred more in monomorphemes than regular past tense verbs, yielding the ranking M > A > P [14].

Guy & Boyd (1990) found that the treatment of semiweaks changes significantly with age, showing a declining probability of deletion as age increases. This highly significant correlation exhibits age-grading only for this class of words. Other external factors, however, (e.g. sex, social class, geographical background, ethnicity as well as style) did not play a salient role. Deletion in the semi-weak class revealed a good clustering of children (aged 0 - 18), with a probability value above .75, while younger adults (aged 19 - 44) and adults (aged 45+) exhibit a mean of .65 and .60, respectively. These findings were summarised into three deletion patterns: pattern

[13] Preceding /r/ was coded as a vowel.
[14] M (monomorphemes), A (ambiguous), P (past tense of regular weak verbs).

I, with high probability of deletion in semiweaks; pattern II, with a probability value between .60 and .75; pattern III, with a probability lower than .60. From a morphological acquisition standpoint, children exhibit nearly categorical /t,d/ reduction as, for them, final coronal stops are not underlyingly present. This means that the past tense is only marked by the stem vowel change[15]. The differentiation of semiweaks from strong verbs begins in the second stage of acquisition (pattern II), where speakers notice /t,d/ in the underlying forms, yet those verbs are still treated as morphologically uninflected. In the last stage (pattern III), speakers can finally distinguish between the apical stops in the semi-weak class and those in regular past tense verbs (e.g. *-ed*).

This pattern was also found by Labov (1989) in a study of a single family, where a 7-year-old child was found to exhibit the same deletion rates as their parents in all morphological classes, yet in the semiweak class the child had a greater rate of reduction.

Roberts (1997) examined (t,d) in language acquisition to find out how this variable behaves in child language and when it is acquired. She interviewed 16 children (aged 3-4) as well as 8 Philadelphian mothers. The children were recorded in their nursery school, located in a working to lower middle-class area of South Philadelphia. Data was coded by morphological status and following phonological environment[16], employing the use of GoldVarb 2.0 to carry out the linguistic analysis. The data was firstly analysed as a group, and then by individual. 13 out 16 children were individually analysed in relation to the following environment, whilst all the 16 children were included in the individual analysis for grammatical contexts. Overall, her results reveal that each child had acquired the following phonetic constraint on (t,d), exhibiting

[15] According to Guy & Boyd (1990) children, in their mental lexicon, only distinguish between weak verbs and strong verbs.
[16] The breakdown of the following environment is: obstruent, liquid, glide, vowel, or pause.

retention of apical stops when followed by a pause. This finding, linked to the fact that deletion before following pause varies geographically (Guy, 1980) and that Philadelphians take seriously the origin of their dialect, suggest that "it is a dialect that is being learned rather than a universal process being applied" (Roberts, ibid: 362) as children's speech pattern, by the age of three, resemble their parents even in the retention of /t,d/ before a pause.

With respect to the morphological class, while Guy & Boyd (1990) show a categorical deletion in semi-weak verbs among the youngest children, in Roberts' findings /t,d/ reduction in the semi-weak class among children equally occurred as in monomorphemes. Since there seems to be a deviation from the adult pattern, she suggests that the children, as a part of a rule-learning process, do not conform to universal tendencies. The children were divided into groups: ten 3-year-olds and six 4-year-olds, yet no significant difference was detected between them. Finally, (t,d) was found to be firstly acquired in terms of grammatical and phonological constraints rather than by style.

The correlation between grammatical and phonological constraints has been recently explored by Tamminga (2018). Specifically, she proposes a modulation of the following segment effect on coronal stop deletion (CSD) by syntactic boundaries. She analysed 118 interviews of the Philadelphia Neighbourhood Corpus (PNC) (Labov & Rosenfelder, 2011). The corpus used is composed of white upper working class and lower working class participants from Philadelphia containing 15,874 tokens for (t,d). Since in white Philadelphian English there are no /rt/ and /rd/ clusters, preceding /r/ was excluded before coding. The syntactic boundaries coded are of two types: strong vs. weak. The former includes Matrix CP + Matrix CP; Matrix CP + Conjunction + Matrix CP (e.g. *And then I make my* ***crust*** ‖ *and I fill it up)* sequences referred to the position of

apical stops between two independent (matrix) clauses; High adjunct + Matrix CP (e.g. *When you get **old**, ‖ everything bothers you)* refers to the presence of a preposed adjunct (e.g. temporal or adverbial phrase); Matrix CP + High adjunct (e.g. *I thought he was a good **friend** ‖ until that point)* is a right-adjoined adjunct placed higher than the verb which carries the target segment. The weak syntactic boundary refers to Verb + Direct (e.g. *You can't **find** ‖ a cork today)* object sequences. Results, obtained from monosyllabic target words, show that the influence of the following segment is stronger across weak syntactic boundaries than across strong ones – a result which is in line with the Production Planning Hypothesis (Tanner et al. 2017). While the inhibition of (t,d) before a following vowel is significantly weakened when the apical stops occur across stronger syntactic boundaries, deletion before a following consonant appears "more stable" regardless of the boundary type.

3.7.3 (t,d) in varieties influenced by Spanish: *Chicano English* and *Tejano English*

This variable also received notable attention in many Hispanic varieties. Hartford (1975), analysed (t,d) in Mexican American English of teenagers in Gary, showing that men reduced /t,d/ clusters more than women. Galindo (1980) explored the same variable in Austin, where the same pattern of deletion was found between Mexican AmE and English.

Santa Ana (1991,1992) investigated (t,d) in the English of 45 Los Angeles Chicanos revealing an effect of syllable stress, with unstressed syllables promoting more deletion than stressed ones**.** He tested the existence of an exponential relationship in the rate of coronal stop deletion. 4,857 tokens were gathered, with 3,724 monomorphemes, 297 semi-weak verbs and 836[17]. With respect to age, adolescents

[17] Details about his findings will be provided in section 3.4.5

seemed more likely to adopt vernacular features than their parents, who are less likely to reduce /-t,d/ in cluster position. Bayley (1994), examining Tejano English, explains that although their parents are all bilingual, English is not usually adopted as their vernacular.

3.7.4 (t,d) in Creole varieties: mesolectal *Jamaican Creole* and *Standard Jamaican Creole*

The absence of final apical stops has also been subject of discussion for Creole languages[18] (Akers 1981; Patrick 1991, 1999; Lacoste 2012). Akers' (1977) results reveal a high rate of /t,d/ absence in JC word-lists (99%) in contrast to other forms investigated (54%), while in SJE word-lists rates of deletion are lower in weak verbs (53%), but still higher than other forms (18%).

A detailed analysis of this variable, in mesolectal JC, is provided by Patrick (1991, 1999). He examined (t,d) at the intersection with past-marking by analysing 2,323 tokens for 10 speakers in Kingston. Internal factors include preceding[19] and following phonetic segments as well as morphological class; while external factors encompass age (from 14 to 82), sex, social class, style. His findings are parallel to the pan-English effects, with more deletion before following consonants (87%) [20] and less reduction before following vowels (63%). Similar to New York (Guy, 1980), a following pause (70%) boosted /t,d/ deletion in mesolectal JC. Patrick (1991, 1999) also points out that the exclusion of /nt/ tokens is an onerous decision to make, as the majority of apical stops in final cluster preceded by nasals are negative contractions

[18] An early suggestion was that "Creoles […] have no initial or final consonant cluster" (Romain 1988, cited in Patrick 1999). Patrick (1999) shows that underlying clusters are present in the mesolect and often may be reduced, especially before following consonants.

[19] JC is non-rhotic in the environment C__V (Wells, 1973, cited in Patrick 1999), hence post-vocalic /r/ was excluded from the analysis.

[20] A slightly higher deletion rate was found for following rhotic (78%) compared to that of glides (74%).

(i.e. morpheme *n't*)[21] and the latter, as also claimed by Labov (1989), heavily favour deletion. Along this line, Patrick (1999: 142) emphasises that *n't* morphemes "generally show the highest rates of (TD)-absence of any morphological class." The latter, indeed, exhibits 87% of /t,d/ simplification in negative contractions, despite the low number of tokens (*n* = 525) compared with monomorphemes (*n* = 1,358). He treated separately a small class of irregular devoicing verbs (e.g. *send, spend, lend, bend, build*) which end in a cluster of sonorants, but form the past by devoicing the voiced alveolar stop. The ranking *n't* (87%) > regular verbs (79%) > monomorphemes (71%) > semi-weak verbs (59%) > irregular devoicing (38%) reveals a very high probability of deletion in weak verbs, which usually tend to favour /t,d/ retention. Through the intersection with past-marking, Patrick (1991, 1999) proves that, in JC, the high deletion rate (79%) in regular verbs (e.g. *called*) is prompted by morphological absence (i.e. non-marking of past tense) rather than phonological deletion. Similarly, in semi-weak verbs tense marking surfaced only almost 50% of the time. His study also shows that ranking of constraints was consistent across the social and linguistic range of informants.

Lacoste (2012) explored the acquisition of (t,d) among children in rural Jamaican schools (Landforest, Bareton and Damont) with particular focus on performance of SJC. Recordings were conducted within the classroom, including teacher's speech, and when the class was no longer engaged. The latter only involved children. Results with respect to the preceding segment show that the fricatives + stop sequence was acquired first by Landforest children as the findings reveal 50% cluster absence, while the lowest rate of (t,d) deletion was found in preceding nasals in Bareton and Damont with a rate of 64%. Interestingly, Landforest children do not show evidence of acquisition of stop

[21] Only few studies have included *n't* tokens in the analysis (e.g. Labov 1989, Patrick 1999). They are usually excluded from sociolinguistic studies of (t,d) owing to possible interaction with *-nt* tokens.

+ stop sequence as deletion is categorical in this context, reaching 100% of /t,d/ absence. Overall, Lacoste (2012) claims that Bareton children adopt clusters in a homogeneous way (76% - 93%), whilst Landforest and Damont children show a more irregular absence rate which fluctuate between 50% - 100% for Landforest, and 68% - 100% for Damont. Teachers' rate of absence differ from that of children, as preceding stops are consistently realised in the teachers' speech giving a rate of /t,d/ absence equal to 51%.[22] The closest rate of performance between teachers (69%) and children (70%) relates to fricatives. Results for the following environment exhibit a higher /t,d/ absence after consonants, whilst vowels disfavour deletion. Following pause behaves like vowels and disfavours at .378. Similar results were also reported for all teachers. Rates of /t,d/ presence were lower in homovoiced than heterovoiced tokens, yet voicing agreement alone was not found to be a powerful constraint. Social factors were minimised in this study as the socio-economic background of speakers is similar and all children belong to the same age cohort.

All the above studies show considerable agreement in the influence of environmental factors and provide precise quantitative accounts on these conditioning effects. But *why* is the ordering of environments so consistent? The section to follow provides an explanation through quantitative theoretical predictions.

[22] The reduction rate of /t,d/ in childrens' speech is 89%.

3.7.5 (t,d) explored on theoretical grounds

To explain whether rates of deletion in semi-weak verbs should be closer to monomorphemes or regular past verbs, and whether (t,d) absence in regular verbs should be a function of deletion rates in monomorphemes, Guy (1991) adopts lexical phonology (Kiparsky, 1982, 1985). Under the lexical phonology approach, (t,d) is explored at a derivational level at which the final consonant cluster is acquired. Guy (1991) applied this theory to empirical findings obtained from seven native English speakers[23], gathered by means of sociolinguistic interview. The four remarkable features of this theoretical framework related to Guy's (1991: 6) purpose are listed below:

1. "multiple levels of lexical derivation;
2. interleaving of morphological and phonological processes;
3. phonological rules may apply at more than one level; and
4. bracket erasure occurs at the end of each level."

This framework suggests that the structure of lexical derivation is systematically arranged into levels, where all morphological processes and many phonological ones are carried out in the lexicon. Within the lexicon there are two or more ordered levels but, as claimed by Harris (1989), two levels are enough to account for variable patterns in English (in Guy 1991). Hence, irregular inflections (e.g. *found*) occur at level one, whereas the attachment of regular inflectional affixes occurs at level two (e.g. *called*). Apical stops in monomorphemes are underlyingly present from the earliest stage of derivation (e.g. *mist*); semiweaks, which are subject to stem vowel change, are treated as undergoing affixation at level one (e.g. *left*); regular past verbs undergo /t,d/

[23] The informants speak North AmE varieties.

affixation at level two. Phonological rules, instead, may not be allocated to particular levels. With the fraction $1 - p_a$, or p_r, Guy (1991) measures retention probability.

He argues that coronal features which were introduced early in the derivation are more likely to undergo deletion, whilst the proportion of items where the rule has never applied will be smaller at each level. Therefore, this theory predicts an exponential development of nonapplication rates for variable rules which apply to different morphological classes, with non-identical derivational histories. This predicts that if a deletion rule operates 50% of the time, it is expected to find a 50% of p_a (or retention) for those forms in which the rule operated only once; in forms where the rule operated twice the retention rate would be 25%; while, when the rule operated three time, rates of retention will be 12.5%. This means that regular verbs undergo /t,d/ deletion once, after affixation at level two and bracket erasure[24], as at earlier levels apical stops are not morphologically present. Monomorphemes, instead, undergo the deletion rule three times: at an earlier morphological stage, after affixation at level one and bracket erasure, and after affixation at level two. Along this line, Guy explains that speakers whose past-marking of semiweaks is obtained by affixation at level one are subjected to the rule application twice: after undergoing affixation at level one and bracket erasure as well as after affixation at level two[25]. Guy's (1991) prediction of deletion in such framework is well-supported by his empirical results exhibiting values of retention equal to .914 for monomorphemes; .877 for semiweak verbs, and .918 for regular verbs[26] and he argues that "the rate of application in each class is *not* independent of the other classes" (Guy, 1991: 19).

[24] That is, the rule application occurs postlexically.
[25] However, not all individuals treat semiweaks this way due to an age-graded acquisitional pattern (Guy & Boyd, 1990).
[26] These are the estimate of p_r in four adults.

Santa Ana (1992) tested Guy's approach and provides evidence of the exponential hypothesis for 45 Los Angeles Chicanos. His findings fit tightly within the lexical phonology framework confirming Guy's (1991) predictions.

As regards the following phonetic segment, Guy's (1991) hypothesis entails a novel prediction. He argues that combining following /r/ and /l/ as sharing a common sonority feature is not quite accurate. Indeed, he split the liquid category by treating /l/ and /r/ separately due to syllabification processes. This means that while **tl-* and **dl-* onsets are prohibited in English, *tr-* and *dr-* are acceptable syllable onsets as both apical stops can resyllabify onto the following segment. This prediction is confirmed by his data revealing that /l/, which favours deletion at .80, patterns with obstruents in triggering deletion, whereas a following /r/ disfavours it (.42)[27].

Fruehwald (2012), with respect to the morphological class, proposes a redevelopment of this class status. He proposes that the treatment of semiweaks in classical (t,d) deletion studies ought to be revised as, along with regular verbs, they should be treated as being identical in phonological deletion, yet differing in terms of morphological realisation. The Kiparsky approach of *Competing Grammars* refers to the notion of speakers possessing different grammars, or different internal grammars based on the use or certain forms or class forms which diverge amongst speakers from different regions, generation, socioeconomic class etc. Under a *Competing Grammars* approach, Fruehwald (2012) investigates whether (t,d) in semiweak verbs is due to morphological absence or phonological deletion, as illustrated in the figure to follow.

[27] In Tejano English, however, Bayley (1994) reports a categorical realisation of /-d/ in the context of a preceding /r/. In Chicano English /-d/, in the same phonological environment, is deleted even though at a very low rate. The influence of Spanish, in both Tejano and Chicano English, concerns the effect of preceding /r/. Indeed, the distinctive features of /r/ Spanish are [+consonantal, -vocalic], while in General American English /r/ is [+consonantal, -vocalic, + central].

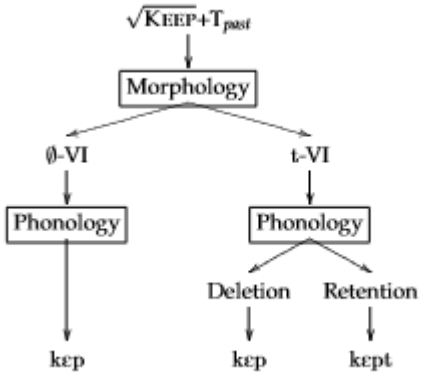


Figure 3.7.1. Competing morphological grammars. Adapted from Fruehwald (2012).

To account for morphological presence, he adopted the following formula:

$$\frac{\text{Observed Semiweak (t,d) presence}}{\text{Regular past (t,d) presence}}$$

showing 93% of /t/ presence in semiweak verbs in the Buckeye Corpus, with only 7% of morphological absence. As outlined in section 3.7.4., this morphological absence was also explored in Jamaican Creole (Patrick, 1991) whereby the highest deletion rate occurred in regular past verbs. This tense marking surfaced only 50% of the time, hence Patrick (1991) concluded that, in JC, the past tense is variably marked.

Similar theoretical approaches cannot be applied to the preceding and following segment effect because, as Guy (1991) claims, they do not spring from derivational history but are due to phonetic and phonological properties, as well as phonotactic principles. Therefore, to theoretically explain why the most deletion occurs before a following consonant rather than before a following vowel, and to explain why the effect of pause varies depending on the dialect, Kiparsky (1994) employed Optimality Theory (OT)[28]. The main principle of OT is that the constraint inventory is universal, or innate, and it is part of a universal grammar (UG). A pivotal notion of this theory is the possibility of constraint violation if constraints are at odds with other constraints,

[28] Unlike the Variable Rule (VR) which is non-categorical and non-deterministic, OT is non-categorical and deterministic.

leading to variable results. In this output-based model the input is retrieved in the output. Through graphical evaluation, OT illustrates the surface form and other potential contenders which may be logically obtained, as illustrated in the table below.

/Input/	Constraint 1	Constraint 2	Constraint 3
Candidate 1			
Candidate 2			

Table 3.7.1 Typical layout of an OT representation.

To answer the above questions, in relation to (t,d), Kiparsky (1994) adopted three constraints: (1) SYLL-WF[29], divided into (a) *COMPLEX (no tautosyllabic clusters); (b) *CODA (no codas); (2) ALIGN, divided into (a) ALIGN-LEFT-WORD (no resyllabification across word boundaries); (b) ALIGN-RIGHT-PHRASE (phrase-final consonants are not deleted); and (3) PARSE[30]. As part of the theory, the constraints are assigned a hierarchical order, and in case of contrast between them, the higher-order constraint wins. The constraint ranking reported by Kiparsky (1994) shows that there is no deletion if PARSE >> SYLL-WF, while if SYLL-WF is ranked higher than PARSE, each sequence implies "a different categorical deletion pattern", as illustrated below:

1. SYLL-WF >> ALIGN>> PARSE, yields cluster reduction in all positions;

2. ALIGN >> SYLL-WF >> PARSE, yields /t,d/ absence before consonants and vowels;

3. SYLL-WF >> PARSE >> ALIGN, yields/t,d/ deletion before consonants and pause.

To account for the preceding segment, Guy & Boberg (1997) took a generalised version of the Obligatory Contour Principle (OCP). The OCP effect predicts that a preceding

[29] SYLL-WF stands for Syllable-well-formedness (Kiparsky 1994).
[30] In OT, the constraint PARSE refers to "underparsing" the input, and in other cases corresponds to a "deletion repair strategy" (Prince & Smolensky, 2004: 48).

segment triggers deletion if it shares the same features with /t,d/ [+cor, -son, -cont], creating OCP clashes. Guy & Boberg's (1997) findings, with a total number of 1,071 tokens, exhibit more deletion after preceding sibilants [+cor, -cont], stops [-son, -cont] and /n/ [+cor, -cont] which share two features with the target segments, than after preceding fricatives /f, v/ [-son], /l/ [+cor], /m, ŋ/ [-cont] which share only one feature.

In regard to the preceding segment, Santa Ana (1996) argues that its effect on the coronal stop deletion is governed by a theoretical sonority hierarchy:

stops > fricatives > sibilants > nasals > /l/

according to which less sonorous preceding segments (stops and fricatives) tend to favour deletion, whereas more sonorous segments disfavour it. However, as Patrick (1991) noted, there seems to be no explanation as to why the place of nasals in the hierarchy is usually higher than that of fricatives in previous (t,d) studies (e.g. Labov 1989). Patrick's (1999) findings, instead, reveal that, in JC, the sonority hierarchy is re-ordered, yielding the ranking: sibilants > stops > fricatives > nasals > laterals.

Lexical frequency was also found to have an impact on the phonological conditioning of sounds (Bybee, 2002). It is argued that even if a gradual change will be lexically regular, it shows lexical diffusion when it is in progress. Lexical diffusion relates to the influence a sound change has on the lexicon. A rapid sound change will affect all words in a language in the same way; while, a gradual lexical change would affect words at different rates or different times[31]. Schuchardt (1885) claims that a sound change influences high-frequency words considerably more than low-frequency

[31] The Neo-Grammarian prediction that a sound change is lexically regular is supported by the fact that when a dialect undergoes a sound change, this change is constantly spread across all items that have the suitable phonetic context (Bybee, 2002). Labov (1994: 542) suggested two types of sound change: (1) a gradual regular sound change is influenced by phonetic reasons, it is not lexically conditioned and has no social awareness; (2) lexical diffusion change occurs with a rapid replacement of one phoneme for another in words where that phoneme is present. He also claims that this can occur often "in the late stages of internal change that has been differentiated by lexical and grammatical conditioning". (t,d) deletion is treated as a "lexical diffusion" change (Labov, 1994) probably due to the rapid phonological reduction of a phoneme.

ones. Bybee (2002) tested this theory on (t,d) deletion on data from AmE, arguing that a phonetically conditioned change which affects high-frequency items before low-frequency ones can be explained through a phonological representation model which permits a change to be both phonetically and lexically gradual. Her assumption that (t,d) is a change in progress contrasts with sociolinguist findings. The data employed for this analysis include *n't* morphemes, regular past tense verbs, and unstressed *-nt* tokens. Her findings reveal that deletion occurred at a higher rate in words with high frequency (54.4%) than in a number of words with low frequency (34.3%). Similar findings were obtained by Jurafsky et al. (2001) in a Switchboard corpus[32] of 2,042 monosyllabic tokens, where word frequency was found to be one of the strongest statistically significant constraints.

A positive correlation between (t,d) deletion and lexical frequency was also found by Guy et al. (2008), who captured the frequency effect by using frequency counts taken over the corpus which they analysed. Their results show interaction between the frequency constraint and morphological class: the cluster reduction rose in monomorphemes with the increase of frequency, whereas lexical frequency had no effect on regular past tense verbs. Higher deletion rate was found in cliticized negative *-n't*, while the lexical item *and* was found to interact with the following word, when the latter was a hesitation. Indeed, in phrases like *'and uh'*, /d/ is more likely to be retained.

Walker (2012) revisited lexical frequency in (t,d) by examining four different corpora, including frequency measures taken over the analysed dataset. His conclusion is that when lexical frequency is measured externally there is no surfacing effect.

[32] This corpus is made of telephone conversations between monolingual American English speakers.

Renwick et al. (2014) explored lexical frequency, along with morphological class, adopting the Audio British National Corpus. Data consists of word pairs (e.g. *past eleven*) with the target feature for a total of 5191 tokens (2037 test tokens). To capture phonetic reduction, they also measured intensity (dB) each 5ms. Results reveal that the intensity of frequent words is shorter and higher compared to that of less frequent words whose intensity is longer and lower. Renwick et al. argue that less frequent words are realised more slowly limiting, therefore, rates of (t,d) deletion.

Purse & Tamminga (2019) take a different stance on the measurement of frequency. Typically, in sociolinguistics, lexical frequency is measured by Wholeword, that is a separate frequency value is assigned to each unique affix whatever semantic, morphological or phonological relation there is between the tokens. In other words, *flower, flowers, meat* and *meet* obtain a different value, while *right* (direction) and *right* (verb) obtain the same value. As Root frequency, instead, "the frequency of each item is calculated as the sum of Wholeword frequencies sharing its stem". This type of lexical frequency measure best captured the (t,d) data from the Philadelphia Neighborhood Corpus (PNC) (Labov & Rosenfelder, 2011). They also measured Conditional frequency, that is "the proportion of an item's parent Root that is constituted by a particular Wholeword, and represents the frequency of a Wholeword given the Root." Purse & Tamminga's (2019) results, hence, reveal that previous hidden frequency effect surface if frequency is measured by Root.

This section has explored (t,d) on theoretical grounds through Lexical Phonology (Guy, 1991), Competing Grammars (Fruehwald, 2012), Optimality Theory (Kiparsky, 1994), Obligatory Contour Principle (Guy & Boberg, 1997), sonority hierarchy (Santa Ana, 1996), with a different take on the sonority hierarchy proposed by Patrick (1999),

and word frequency (Bybee 2002; Guy et al. 2008; Walker, 2012; Purse & Tamminga 2019).

3.8 (t,d) in British English dialects

While this variable has been extensively investigated both empirically and theoretically in many North American dialects, it has received comparably little attention in the UK. Indeed, it was explored only in York (Tagliamonte & Temple, 2005), Manchester (Baranowski & Turton, 2020), in standard British English (Pavlík, 2017), in Mersea Island (Amos et. al, fc), and in Tyneside English (Woolford, 2018). Pavlík (2017) and Amos et al. (fc), however, distance from the usual treatment of (t,d) as one variable.

3.8.1 York

The first attempt to replicate North American (t,d) studies on a British English variety was carried out by Tagliamonte & Temple (2005). To account for this sociolinguistic variable the data was taken from the York English Corpus (Tagliamonte, 1998) which includes native British English speakers living in York or nearby the city. The sample, for this analysis, includes 38 speakers equally distributed in terms of sex, while age is treated as a continuous variable (between 16 and 91 years of age). In addition to the usual neutral contexts, questions, negatives, interrogative constructions and following interdental fricatives (e.g. *called them*) were excluded from analysis. 1232 tokens - 125 of which were realised with glottal stop or glottalization[33] – were analysed. The coding for the morphological class differentiates between monomorphemes (e.g. *mist*),

[33] These reflexes of /t,d/ were treated as nonapplication of the reduction rule.

semiweaks (e.g. *kept*) and past tense verbs (e.g. *missed*), while suppletive (e.g *found*), replacive (e.g. *sent*) and preterit *went* were coded separately[34].

Similar to previous US findings, results confirm the greatest conditioning effect of the following phonological segment, with obstruents (.83), glides (.70), /r/ (.60) favouring deletion, whereas vowels (.30) and pause (.20) disfavour it. However, the neutral position of /l/ (.50) in York is not consistent with the re-syllabification process advanced by Guy (1991). The preceding phonological segment, a usually weak constraint, surfaced as the second most significant predictor in York yielding the ranking:

sibilant > nasal > liquid > stop > non-sibilant fricative,

where sibilant is the only favouring factor. The most surprising finding from the York data is linked to the morphological class. As outlined in previous sections, the morphological class is one of the strongest paradigmatic constraints of (t,d) in all North American (t,d) studies. By contrast, in York, the morphological effect failed to reach statistical significance. Even after they reanalysed the data leaving out preterite *went*, replacive verbs and strong preterites, the outcome did not change as the morphological class was still not selected as a significant predictor. The interaction between phonological and morphological categories revealed that the following environment operates similarly for each morphological class; the preceding segment was not marked as significant for the semiweak class due to the low number of tokens in this category. Preceding /s/ was found to be high across monomorphemes, semiweaks and regular past tense verbs, while preceding stops were higher for the semiweak class. The argument which supports the lack of morphological effect in British English is due to the high presence of preceding sibilants, such as /s/, in monomorphemes; hence coronal

[34] Preterite *went* and replacive verbs were found to exhibit categorical /t,d/ retention.

stop deletion might not be due to the morphological class itself, but it is influenced by the preceding phonetic environment (Temple, 2009). A similar finding was also reported by Sonderegger et al. (2011), who claim that there is no morphological effect in British English, as when the preceding phonological context is taken out from the model, the morphological effect disappears. Sonderegger et al. (2011) investigated (t,d) deletion in the speech of participants in the UK *Big Brother* reality TV programme. In the light of this result, Tagliamonte & Temple (2005: 282) claim that "our findings call into question the universality of the morpho-phonological effect and have led us to reconsider the possibility that the conditioning of the rule is primarily phonetic/phonological." They concluded that (t,d) behaves variably, and that the theoretical explanations advanced for this feature (OCP, Lexical Phonology and resyllabification) do not hold for the York data. As regards social factors, age was not an influential predictor, and males deleted more than females.

3.8.2 Manchester

While the data from York report no evidence for the largely reported morphological effect found in American English dialects, data from Manchester exhibit the usual "robust morphological effect" (Baranowski & Turton, 2020). Hence, (t,d) in the British scenario is strongly marked by this conflicting morphological outcome.

For the Manchester study, Baranowski & Turton (2020) interviewed 93 speakers, aged 8-85, who were raised in Manchester. The sample includes 64 White British informants, 17 Pakistani, and 12 Black Caribbean Mancunians, stratified by sex and by socio-economic class: lower working, upper working, lower-middle, middle middle, and upper-middle. The external factors also include ethnicity, style (casual, careful, language, minimal pairs, word list) and word frequency from the SUBTLEX-

UK corpus (van Heuven et al. 2014). The dependent variable is coded as binary (i.e. [t,d] absent or present), with glottal stop replacements coded as [t,d] presence. Besides the usual neutral environments, they also excluded following /j/ (e.g. *last year*)[35], negative contractions and following /h/. The latter was excluded since the analysis was based on orthographic transcriptions only, and the Manchester dialect exhibits a mean of 30% of /h/ dropping (Baranowski & Turton, 2015). A total of 19,550 tokens - 18,274 of which come from spontaneous speech – was analysed through mixed-effects models in R, with speaker and word as random effect[36]. The morphological effect turned out to match the American pattern, with monomorphemes triggering deletion, whilst regular past tense verbs disfavour it. Result from the preceding phonetic environment yield the following ranking: sibilants > affricate > nasal > stop > fricative > lateral.

Post-sonorants /n/ and /l/ (e.g. *aunt, halt*) were subsequently excluded from this environment as they were found to be obligatorily realised with glottal variants. They argue that glottaling blocks deletion, especially among monomorphemes where the highest rate of post-sonorant tokens occurred. The hierarchy for the following phonetic context exhibits more deletion in consonants, whereas pause and vowel disfavour the cluster reduction. Word frequency was marked as a significant predictor, with a higher deletion rate occurs in more frequent tokens, as shown below, while social factors do not exhibit significant conditioning.

[35] The palatal glide was initially included in this study, yet removed later on due to onerous reliability in distinguishing between deletion and palatalization.
[36] Their final converging model was an "intercept only model for speaker" due to the little inter-speaker variation in their dataset. Standard deviation for word was higher than for speaker.

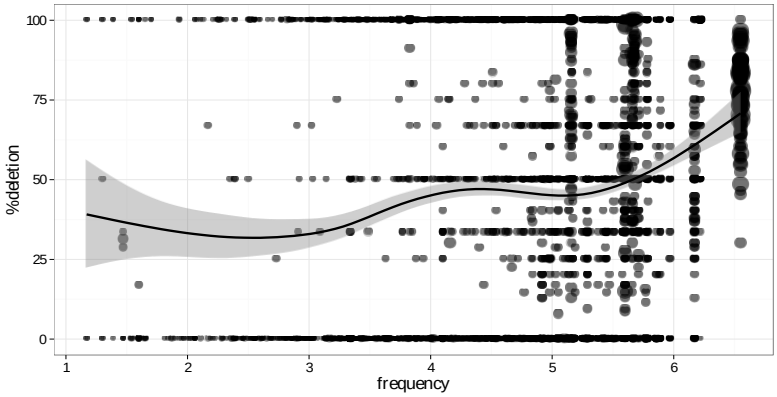


Figure 3.8.1 Word frequency from SUBLEX-UK in Manchester (Baranowski & Turton, 2020).

3.8.3 Northeast of England

Similar findings have been reported in other northern British varieties. Woolford (2018), has examined 24 speakers taken from the *Newcastle Electronic Corpus of Tyneside English* reporting the expected morphological effect for (t,d), and a nearly negligible difference between monomorphemes and semiweaks (the deletion rate in monomorphemes is slightly higher). Social factors (age, sex, and social class) were all marked as significant predictors, with an increase of /t,d/ reduction in monomorphemes and semiweaks in apparent time. Woolford confirms earlier suggestions by Baranowski & Turton (2016), that is: (t,d) is advancing through the life cycle of phonological processes (Bermùdez-Otero, 2015), according to which a phonological process begins by applying at lower levels of the grammar, such as at the word level (e.g. effecting *missed* and *mist*) and over time it spreads to the stem level (e.g. *mist* only). Thus, British English is behind US English dialects in the stem level (Baranowski & Turton, 2016; Woolford, 2018).

3.8.4 Mersea Island

Amos et al. (forthcoming), on the contrary, take a different approach in exploring (t,d): they suggest to treat the two coronal stops separately. Johnson & Amos (2016) argue for a separate analysis of /t/ and /d/ as they appear not to share the same distribution in word-final consonant clusters as well as in the various morpheme forms. This suggests that in British English /t/ is more likely to glottalise rather than delete following /n/ and /l/; therefore, they argue that /t/ glottalization and /t/ deletion are in complementary distribution. They also argue that in monomorphemes /t/ may only occur after /p, f, s, k/, whilst /d/ only occurs after /l, n/.[37]

The sample for the Mersea Island[38] (Amos et al., forthcoming) study consists of 8 speakers, two males and two females aged 19-24, and two males and two females aged 60-75. The internal factors taken into account are the preceding and following phonetic segment, morpheme type and inflectional status (free and bound morphemes), intonational boundaries, and word class distinguishing between true monomorphemes, regular past tense verbs, semiweaks, irregular strong verbs, regular adjectival forms, and irregular adjectival forms. Results from a total of 897 tokens[39] show that deletion rates were higher for (d) (24.1%) than for (t) (17.6%). Neither age nor gender were statistically significant. The significance of internal factors varies depending on the variable, that is: the following phonetic environment and intonation boundary surfaced as significant factors in the (t) analysis, whereas the following and preceding phonetic segments emerged for (d) deletion. The following environment for (t) yields the following ranking:

obstruent > nasal > glide > liquid > pause > vowel

[37] However, this statement does not hold for words like *ant*.
[38] Mersea Island is located in North Essex near Colchester.
[39] 491 tokens for (t) and 406 tokens for (d).

with pause and vowels disfavouring deletion. The intonation boundary, which surfaced for (t), exhibits a near categorical deletion rate for medial (91%) as opposed to final (9%) position of the target word.[40] As regards (d), the following context yields the ranking:

obstruent > liquid > glide > vowel > pause

with pause and vowels disfavouring the cluster reduction, while the preceding context shows that nasals and sibilants favour coronal stop simplification, but stops and liquids disfavour it. Morphological class and external factors show little significant influence. The approach of treating separately the two apical stops has been also adopted by Pavlík (2017), who investigated this variable in standard British English.

3.9 (t,d) in Standard British English

Pavlík (2017) investigated (t) and (d) through BBC radio bulletins, in word-final consonant clusters as well as word-internally at the morpheme boundary (e.g., *gran<u>d</u>father*, *exac<u>t</u>ly*, etc.). The coding of morpheme-final (e.g. *lan<u>d</u>lord*) along with word-final /t/ and /d/ is not a common practise in the study of this variable, hence it raises the question of encompassing "potentially contrasting linguistic environments" (Amos et al., fc) under the same category.

The classification of /t,d/ retention includes both released [t,d] and glottal(ised) tokens, while the commonly excluded neutral environments, such as /t/, /d/, /tʃ/, /dʒ, /θ/, and /ð/ were also taken into account. This news-reading study does not lead to an informal speech style, indeed, Pavlík (2017) emphasises that in such a formal context /t,d/ was not categorically simplified in Ct#t or Cd#d sequences, or in the highly

[40] Amos et al. (forthcoming) provide the following examples for medial and final position: 1) That was the *last* film I saw (medial); 2) He saw my keys *last* (final).

frequent lexical item *and*. His findings confirm the strong effect of the following environment; morphological class is not statistically significant, whereas the effect of the preceding environment varies (e.g. it influences the /d/ presence, yet this does not have an effect on /t/). The interaction between preceding and following contexts shows that the reduction of /t/ and /d/ occurs more frequently when the neighbouring segments clash with the coronal place of articulation of /t,d/ and with the occlusion stricture.

3.10 Summary

This chapter has reviewed (t,d) deletion in both North American and British English studies. The pan-English effect shows a notable internal agreement among US English dialects, while in England contrasting findings have been found with respect to the morphological effect in those studies where (t,d) was treated as one variable.

	Prec. Env.	**Foll. Env.**	**Morph. Class**
American studies			
Labov (1967)		C, V	M, R
Wolfram (1969)	stop, son, fric	C	M, R
Fasold (1972)	fric, son	C, V, P	S, R
Creole variety			
Patrick (1999)	sib, stop, other fric, nas, lat	C, R, G, P, V	*n't*, R, M, S, ID
UK studies			
Tagliamonte & Temple (2005)	sib, nas, liq, stop, non-sib fric	obstr, G, /r/, /l/, V, P	non-significant
Baranowski & Turton (2020)	sib, affric, nas, stop, fric, lat	C, P, V	M, S, R
Woolford (2018)			M, S, R

Table 3.10.1 (t,d) deletion: Comparison of seven studies. C = consonants, V = vowels, M = monomorphemes, R = regular past tense verbs, P = pause, R = rhotic, G = glide, ID = irregular devoicing.

In the light of the above findings, this study addresses the following descriptive and theoretical research questions broadly presented in Chapter 1.

Descriptive aims:

1) How does (t,d) behave in East Anglia?
    - The hypothesis is that if major constraints are generally parallel across dialects of English, location should not be an essential factor in East Anglia (or Britain);
2) Since the following phonological environment strongly affects the deletion of /t,d/ across the English varieties, we may want to explore this linguistic context more closely to gain a deeper understanding of the universality of this internal constraint. Therefore, is the classical coding (e.g. obstruents > glides > /r/ > /l/ > vowels > pause) sufficient to account for this weighty constraint, or do we need to break down the obstruent category further?[41]
    - The hypothesis is that by grouping the obstruents together some relevant differences might be obscured.
3) This study also set out to shed light on the unsolved problem of morphological effect in British English;
    - The hypothesis is that if pan-English effects show notable agreement in internal ordering, the morphological class should be a significant, predictable constraint;
4) Is phonetic reduction highly conditioned by word frequency?
    - The hypothesis is that deletion occurs more in high-frequency words.

Theoretical aims:

5) Is (t,d) governed by a universal sonority hierarchy in British English?

[41] A similar question could be addressed for following vowels, yet they are consistently marked as a disfavouring factor due to resyllabification processes. Obstruents, on the contrary, surface as the most favouring predictor.

- The hypothesis is that less sonorous preceding segments tend to favour deletion, whereas more sonorous segments disfavour it (Santa Ana, 1996). However, given the consistent lack of finding a sonority hierarchy result in the British context, it would not be surprising to find a similar result in East Anglia.

6) Is the Obligatory Contour Principle (OCP) an explanatory factor?

- The hypothesis is that the more features of phonetic context are shared with /t, d/, the more likely deletion is to occur (Guy & Boberg 1997).

7) Does an exponential relationship hold among morphological categories?

8) Exploring (t,d) under a Competing Grammars approach.

- Is variation in deletion of semi-weak verbs partly due to morphological absence?

Chapter 4 - (t,d) DELETION: RESULTS AND DISCUSSION

Before attempting to answer the questions previously raised, this Chapter briefly recaps the analytical procedures employed in the present survey and identifies some issues in the formerly discussed (t,d) literature (e.g. the treatment of the following phonological environment). I will then present and discuss the overall results (all three localities together), examined through mixed-effects Rbrul regression analysis. The three localities are firstly combined, as they are part of what Trudgill (2001a: 10) defines as "linguistic East Anglia"; secondly, the three urban areas will be treated separately so that results from each community can be compared and contrasted.

4.1 Analytical procedure - linguistic constraints

In the literature, the surrounding phonetic segments (preceding and following environments) for the (t,d) variable have been mostly analysed according to the manner of articulation (e.g. Labov et al.1968; Wolfram 1969; Guy 1991; Patrick 1991; Tagliamonte & Temple 2005; Baranowski & Turton 2020). Data of the present research was initially coded according to both manner and place of articulation[1], however the latter showed a lower proportion of the variance in the response and exhibited a small effect size, which was measured with the standardized R^2 (Winter, 2020)[2]. Parallel findings were reported by Neu (1980) whose study shows that the place of articulation

[1] Manner and place of articulation were not included in the same run since they are collinear, and thus highly correlated.
[2] See section 2.6 for model comparison.

is a non-significant constraint. The final model (see table 4.1), therefore, includes only the manner of articulation for preceding and following phonetic segment.

In early studies on (t,d), only two categories were distinguished for the following phonological segment: following vowel vs. non-following vowel (Labov et al, 1968) or following consonants vs. non-consonants (Wolfram, 1969). The category of non-following vowel included liquids, pauses and glides. Pause was then excluded from the consonant factor group and started to be coded as a separate constraint with Fasold (1972)[3]. Subsequently, linguists broke down the consonant category into: obstruents (stops, fricatives and nasals), glides, /r/, /l/, vowels and pause (Tagliamonte & Temple 2005[4]). This study continues to break down the consonant category further and treats separately:

a. stops
b. sibilant fricatives
c. non-sibilant fricatives and
d. nasals (sonorants).

The reason for examining more closely this factor group is twofold:

(1) the following phonological environment has proven to be the most weighty constraint, hence it is worth speculating on the effect that each and every factor may have on the deletion rate. Since the manner of articulation exhibits a higher proportion of variation for this variable, the degrees of closure of a following phone could be taken into account[5]. From an articulatory viewpoint, the degree of stricture differs for

[3] However, since the effect of a following consonant (38.6%) and that of a following pause (39.1%) was nearly identical, the following phonetic segment was consequently coded as: following consonants vs. following vowels.

[4] In Tagliamonte & Temple (2005: 288) the obstruent category for the following phonetic segment includes nasals.

[5] To describe the manner of articulation, phoneticians sometimes divide the sounds based on the degree of closure, distinguishing between: closure, close approximation and open approximation (e.g. vocoids, in which the airflow is smooth). Further distinctions encompass whether the air flows through the nose (nasal) or otherwise (oral).

plosives, fricatives and nasals. Plosives and nasals could be grouped together since they both exhibit a complete closure. However, while plosives have a *complete* closure in the vocal tract followed by an explosive release of the airflow (e.g. [p,b,k,g])[6], for nasals the degree of closure decreases and the airflow escapes through the nose. Fricatives, instead, are realised through a close approximation of two articulators and the airstream resulting in a friction, which is partially obstructed.

(2) If sounds are classified based on their noise components, only plosives and fricatives can be included in the obstruent category[7], where "the constriction impeding the airflow through the vocal tract is sufficient to cause noise" (Cruttenden, 2014: 31). Nasals, instead, show no noise component and are more vowel-like (Cruttendan, 2014). However, they have also been treated as obstruents as the flow of air through the mouth is blocked.

With respect to fricatives, I have also distinguished between sibilant fricatives and non-sibilant fricatives in the following phonetic context. Usually, it is recommended to combine factor groups which are correlated with the response or if they represent the same manner of articulation to reduce the deviance (Tagliamonte, 2006). However, I believe that collapsing predictors without testing how individual factors behave could obscure some relevant influences on the variation of the target dependent variable. The decision of treating sibilants and non-sibilant fricatives separately in the following phonetic context is also conceptually validated as /s/ and other fricatives were consistently found to behave differently in environments preceding /t,d/ (Bayley 1994; Patrick, 1999; Tagliamonte & Temple 2005). Therefore,

[6] Following [t] and [d] are excluded from the analysis, therefore not mentioned here.
[7] Affricates are also classified as obstruents, but they are excluded from the following segment here, for the purposes of this study.

they might have a statistically distinct influence on (t,d) deletion even in the following environment, such as in *around some, at last he moved,* etc.

In the (t,d) literature, following vowels (e.g. *dent in*) are usually grouped together. Despite being marked as a disfavouring factor due to the resyllabification of the apical stops /t/ and /d/ onto the following segment, I determined to break down the vowel category into high-vowels, mid-vowels and low-vowels to examine whether deletion is consistently disfavoured in all three cases. Initial Rbrul runs, indeed, showed that the realisation of [t,d] is inhibited when followed by any vowel type. To obtain the neatest and most accurate model, these three factor groups were then collapsed.

Occurrences followed by /t/, /d/, interdental fricative /θ/, /ð/, post-alveolar fricatives /tʃ/, /dʒ/, the lexical item *and,* tokens where /t,d/ is preceded by the approximant /r/ (i.e. historically rhotic), as well as word-final /t/ tokens realised with a glottal stop were excluded from the analysis[8]. Final clusters following /l/ (e.g. *halt*) were only coded when /l/ was consonantal; whereas, cases in which /l/ was vocalised were also excluded from the analysis as the apical stops /t/ and /d/ would no longer be in a final consonant cluster. Glottal variants are excluded from the main (t,d) regression analysis as (t) glottaling carries social meaning in East Anglia and in other UK speech communities, thus I argue that (t) glottaling is a different variable even though clusters containing glottal variants (e.g. *silent*) have been included in previous (t,d) studies (see Tagliamonete & Temple 2005; Baranowski & Temple 2020). The decision of excluding glottal variants from the (t,d) analysis also aligns with Amos et. al's (2020) study, according to which glottalization, in British English, is a case of lenition rather than deletion, therefore it is a separate phenomenon.

[8] In most cases, the dependent variable is categorically coded as [t,d] presence vs. deletion of /t,d/. Unlike other English varieties, in British dialects /t/ can be frequently glottal(ised), hence UK (t,d) studies have treated the glottal variant as a case of [t,d] presence.

However, as a point of comparison with Manchester (Baranowski & Turton 2020) and York (Tagliamonte & Temple 2005), I will firstly present a model with spontaneous speech only, where glottal variants are coded together with [t,d] presence (see section 4.3).

4.2 Analytical procedures – Rbrul

Across the 36 interviews conducted in the three cities, a total of 4,879 tokens was coded into an Excel spreadsheet. To have sufficient data for statistical analysis, at least 30 tokens per cell are recommended (Guy, 1980)[9]. The large number of tokens in the East Anglian dataset, however, is well above this statistical threshold averaging 135 tokens per speaker, and it is evenly distributed between age, class sex, and location, as shown in Appendix I.

As discussed in Chapter 2, the statistical tool employed to carry out this variationist analysis is Rbrul. The initial model was run with all factors to identify the most important predictors as well as any potential interaction. In the second step of the analysis, I run step-up and step-down separately to test for their respective relevance on the variation of (t,d). Finally, a step-up/step-down analysis was conducted.

The type of response in the model is binary, with deletion as application value and individual speaker and word included as random effect. Along the line of Baranowski & Turton (2020), the most complex model tested included by-speaker as random slope for following phonetic segment and morphological class[10]. Since these constraints were found to vary across varieties, they might also vary across speakers. Crosstabulations

[9] See also Milroy (1987).

[10] Besides random intercepts, mixed-effects models can also include random slopes. This means that the model allows speakers "not only to differ in the rate at which they use a variant, but also to differ in the size of the effect between-word constraints, such as phonological context" (Gorman & Johnson, 2013: 224).

between the response and each linguistic and social factor were carried out to observe for potential knock-outs before building the final model, illustrated in section 4.4.

Constraints	**Factors**
Preceding environment	nasals (e.g. *remind*)
	sibilants (e.g. *cost)*
	fricatives (e.g. *raft*)
	laterals (e. g *old*)
	stops (e.g. *strict*)
Following environment	nasal (e.g. *soft moan*)
	sibilant (e.g. *best source*)
	stops (e.g. *second could*)
	laterals (e.g. *don't like*)
	glides (e.g. *second world*)
	rhotics (e.g. *planned reunion*)
	vowels (e.g. *went on*)
	pause (e.g. […] *was lost.)*
Morphological class	monomorphemes (e.g. *mist*)
	semi-weak verbs (e.g. *left*)
	regular verbs (e.g. *called*)
Voicing agreement	homovoiced (e.g. *bold*)
	heterovoiced (e.g. *bolt*)
Syllable stress	unstressed (e.g. *happened*)
	stressed (e.g. *left*)
Style	Spontaneous speech
Word frequency	low frequency (1-3); high frequency (4-7)
Social class	working class, middle class
Age	young (18-28), middle (35-50), older (60+)
Sex	female, male

Table 4.2.1 Constraints of the (t,d) variable in the East Anglian dataset, with glottals included.

The difference between the model illustrated in section 4.4 and the model above is that the latter includes glottal variants, it excludes *n't* tokens and it is based on spontaneous speech only, whereas the model in section 4.4 examines (t,d) deletion across all styles (spontaneous speech, reading passages and word lists), it includes the morpheme {*n't*} in the morphological class, and excludes glottal variants from the dataset.

4.3 Overall Results – model with glottal variants included in the (t,d) dataset

This section briefly presents the results from the mixed-effects regression analysis with glottal variants included in the (t,d) model, along the line of Tagliamonte & Temple (2005) for York, and of Baranowski & Turton (2020) for Manchester. The number of glottal variants in the East Anglian dataset equals 384. In York, glottals represented 10% of the data (*N* = 125), whereas in Manchester 82% of /nt/ and /lt/ clusters were glottalled[11]. In line with previous UK (t,d) studies, this section excludes *n't* tokens from the dataset.

The statistical information contained in the table to follow includes: R^2, which is a measure of the 'goodness of fit' (Winter, 2020); log-odds, which reflect the strength of the relationship between a predictor and the response – if log-odds are above 0, there is a positive correlation between the variables, whereas if they are negative there is a negative correlation between them; factor weights are relative probabilities within the range of 0 – 1.00 and are related to log-odds; AIC "is a goodness-of-fit measure for comparison of models with different numbers of parameters" (Levshina, 2015: 194).

[11] /t/ in post-sonorant position (e.g. *halt*, *aunt*) where excluded in Manchester as they categorically realised with glottal variants.

Moreover, in the logistic regression with a binary response, p-values come from a likelihood-ratio chi-squared test.

Application value = deletion; overall proportion = 0.324 R^2 = 0.362; log likelihood = -1387.24; N = 2750; AIC = 2808.481				
Constraints	**Logodds**	**FW**	**%**	**Tokens**
Voicing Agreement p <.001				
heterovoiced	0.532	0.63	54	547
homovoiced	-0.532	0.37	27	2203
Preceding env. p<.001				
nasals	0.683	0.664	44	1148
sibilant fricatives	0.448	0.61	33	761
/l/	-0.03	0.493	28	204
stops	-0.368	0.409	13	338
non-sibilant fricatives	-0.734	0.324	11	299
Following env. p<.001				
nasals	1.221	0.772	63	145
sibilant fricatives	1.215	0.771	67	124
stops	0.933	0.718	61	222
/l/	0.65	0.657	55	40
glides	-0.043	0.489	40	272
non-sibilant fricatives	-0.167	0.458	34	228
vowels	-0.9	0.289	22	979
pause	-1.091	0.251	22	715
/r/	-1.818	0.14	16	25
Morphological class p<.001				
semiweak verbs	0.452	0.611	44	329
monomorphemes	0.221	0.555	38	1762
regular verbs	-0.673	0.338	13	659

Table 4.3.1 Multivariate analysis of (t,d) in East Anglia, including glottal variants.

Results from the multivariate analysis revealed that, in East Anglia, when only spontaneous speech is taken into account, voicing agreement, preceding phonological environment, following phonological environment, and morphological class are marked as significant predictors. Thus, similar to Manchester, morphological class reached statistical significance. Table 4.3.1, which displays results obtained from the best step-up/step-down model, shows that heterovoiced tokens favour more deletion than homovoiced ones – a finding which goes against previous (t,d) studies (see section 4.4.2). In the preceding environment, the only favouring predictors are nasals and sibilant fricatives, with nasals being at the top the ranking; whereas, preceding /l/, stops and non-sibilant fricatives disfavour deletion. While the behaviour of most predictors is in line with Manchester and York, the high position of nasals in East Anglia contrasts with the two northerner cities. Results from the following environment reveal that sibilant fricatives and non-sibilant fricatives behave very differently (see section 4.4.1). Nasals, sibilant fricatives, and /l/ favour the absence of /t,d/, whilst glides, non-sibilant fricatives, vowels, pause and /r/ are marked as disfavouring predictors. The different behaviour of /r/ and /l/, in East Anglia, is consistent with previous US (t,d) studies (see section 4.4.1) whereas, in York, /l/ is in a neutral position. Vowels and pause also disfavour /t,d/ in both Manchester and York, yet following glides favour the simplification of /t,d/ in York. With respect to the morphological class, semi-weak verbs appear at the top of the ranking favouring deletion at 0.611, monomorphemes favour at 0.555, while regular verbs, as expected, disfavour it. In a further run (not shown here) glottal variants were excluded from the above model (with spontaneous speech only). Results revealed that the difference between the two models is not statistically significant (see section 2 for model comparison). In other words, the model with glottal variants is not significantly different from the model without glottal

variants. AIC for the model with no glottals equals 2431.785, which is lower that the AIC displayed in table 4.3.1. This means that "the smaller the AIC, the better the fit" (Levshina, 2015: 149). Moreover, since I contend that (t) glottaling is a different sociolinguistic variable in British English, in the next section, glottal variants will be excluded from the (t,d) dataset, all styles (spontaneous speech, reading passages, word lists) will be examined and negative contractions *n't* will be taken into account for a thorough account of the (t,d) variable.

4.4 Overall Results – model with no glottal variants included in the (t,d) dataset

Figure 4.4.1 displays the overall findings for (t,d) deletion across the East Anglian sample where the stability of this variable surfaces. The simplification of word-final /t,d/ appears to be equally distributed across the three age cohorts, sex and social class. Middle class females exhibit a relatively lower deletion rate in the middle-aged (22%) and in the old (19%) groups. On the other hand, young middle class females, along with young middle class males, show a slightly higher (t,d) absence rate compared to working class males and females. Further negligible differences between social factors will be commented on later in the Chapter. Let us now turn the attention to the mixed-effects regression analysis.

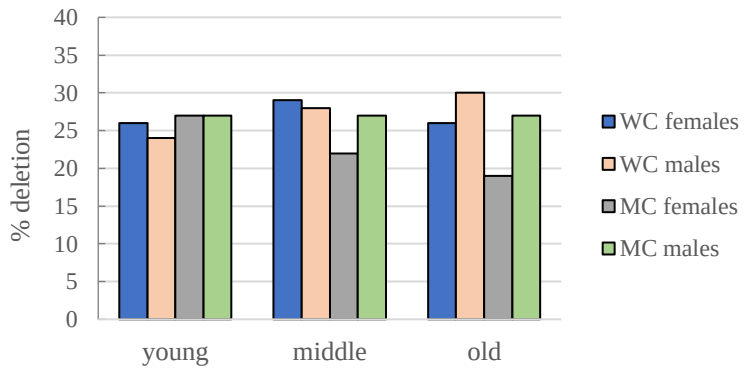


Figure 4.4.1 Overall results in the East Anglian dataset.

Table 4.4.1 summarises the constraints included in the final model.

Constraints	**Factors**
Preceding environment	nasals (e.g. *remind*)
	sibilants (e.g. *cost)*
	fricatives (e.g. *raft*)
	laterals (e. g *old*)
	stops (e.g. *strict*)
Following environment	nasal (e.g. *soft moan*)
	sibilant (e.g. *best source*)
	stops (e.g. *second could*)
	laterals (e.g. *don't like*)
	glides (e.g. *second world*)
	rhotics (e.g. *planned reunion*)
	vowels (e.g. *went on*)
	pause (e.g. […] *was lost.)*
Morphological class	monomorphemes (e.g. *mist*)
	semi-weak verbs (e.g. *left*)
	regular verbs (e.g. *called*)
	negative contractions (e.g. *can't*)
Voicing agreement	homovoiced (e.g. *bold*)
	heterovoiced (e.g. *bolt*)
Syllable stress	unstressed (e.g. *happened*)
	stressed (e.g. *left*)
Style	spontaneous, reading styles, word lists
Word frequency	low frequency (1-3); high frequency (4-7)
Social class	working class, middle class
Age	young (18-28), middle (35-50), older (60+)
Sex	female, male

Table 4.4.1 Constraints of the (t,d) variable in the East Anglian dataset, without glottals.

Results of the best model achieved in the step-up/step-down analysis are presented in table 4.4.2. In the step-up analysis, the programme adds predictors one at a time, beginning with those which have the greatest effect on the dependent variable. This process is repeated until no more significant predictors can be added. In the step-down analysis Rbrul fits the full model and removes those independent variables which are not significant. The findings pattern with previous North American studies, as the logistic regression shows that following environment, voicing agreement, morphological class, style and preceding environment are statistically significant, whilst none of the social factors (social class, age and sex) has a significant influence on the dependent variable. Parallel to previous studies on (t,d), this research confirms that the explanatory factors for this variable are linguistic rather than social (see section 4.4.6). The predictors which reached statistical significance in the mixed-effects regression analysis are examined more closely in the following sections.

Application value = deletion; overall proportion = 0.257
R^2 = 0.672; log likelihood = -1588.162; *N* = 4,879

Constraints	Logodds	FW	%	Tokens
Following Env. **p< .001**				
nasal	1.489	0.816	64	197
sibilant fricative	1.444	0.809	77	192
stops	0.798	0.69	55	424
/l/	0.140	0.535	56	44
glides	-0.305	0.424	39	298
/r/	-0.331	0.418	29	81
non-sibilant fricative	-0.331	0.418	32	343
vowels	-1.231	0.226	18	1405
pause	-1.672	0.158	10	1895
Voicing Agreement **p< .001**				
heterovoiced	1.22	0.772	64	891
homovoiced	-1.22	0.228	17	3988
Style **p< .001**				
spontaneous speech	1.461	0.812	37	2710
reading style	0.236	0.559	19	1131
word list	-1.696	0.155	3	1038
Morphological class **p<.001**				
n't negative contractions	0.774	0.684	83	196
monomorphemes	0.182	0.545	37	2204
semi-weak verbs	-0.066	0.483	21	687
regular verbs	-0.889	0.291	7	1792
Preceding Env. **p<.001**				
nasal	0.703	0.669	40	2003
sibilant fricatives	0.473	0.616	23	1226
/l/	-0.211	0.447	17	357
stops	-0.358	0.412	7	728
non-sibilant fricatives	-0.607	0.353	7	565

Table 4.4.2 Multivariate analysis of (t,d) in the whole dataset.

4.4.1 Following environment

The extensive literature on (t,d) deletion has shown that this linguistic variable is strongly constrained by the following phonetic segment. Early empirical (t,d) findings exhibit the following hierarchy in many variationist studies of American Englishes:

Consonant > Liquid, Glide > Vowel

with consonants being the most favoured and vowels the least favoured predictor. Results from the East Anglian analysis confirm that following phonetic segment has a robust effect on (t,d) with nasals, sibilants, stops and /l/ favouring deletion, whereas glides, /r/, non-sibilant fricatives, vowels and pause disfavour it. Nasals turned out to trigger deletion the most at .816, along with sibilants (.809). The latter differs greatly from non-sibilant fricatives which, by contrast, disfavour deletion at .418. This result suggests that previous research that merged these two factors (sibilants and non-sibilant fricatives) in the obstruent category, may have obscured this difference[12]. A likelihood ratio test revealed that treating sibilants and non-sibilant fricatives separately is statistically significant (x^2 (1) = 52.24, $p < .001$). It is worth noting that non-sibilant fricatives outnumber sibilants in this dataset, with 343 tokens and 192 respectively. The low position of non-sibilants in the hierarchy, at this point, requires some more detailed comment. Firstly, it should be noted that spirants included in the East Anglian dataset are following [f], [v] and [h], but let us briefly go back to the classification of obstruents. These sounds are articulated with the obstruction to the airstream in the mouth and, consequently, the glottal [h] is not included in this category (Roca & Johnson, 1999). Thus, it could be assumed that: (a) previous studies grouped following

[12] Similarly, since laterals and rhotics have different status, Guy (1991) argued for subdivision of the liquid category and found that the effect of /l/ is dissimilar to that of /r/.

/h/ with obstruents; or (b) following /h/ has been excluded from the analysis, as in Manchester (Baranowski & Turton, 2020). Moreover, following /h/ has been recently referred to as a problematic case to establish whether the deletion rule applies post-lexically (Temple, 2017). In the following context, indeed, /h/ is underlyingly consonantal, but may be phonetically a vowel especially in accents which exhibit (h)-dropping. East Anglia, however, is one of the parts of England where /h/ is retained especially in rural dialects, at least amongst older speakers (Trudgill, 1974):

Figure 4.4.2 /h/ in hammer. Adapted from Trudgill (1974).

In the present analysis, following /h/ was coded on the phonetic surface. Thus, when underlyingly /h/ was phonetically consonantal it was coded as a spirant[13], when it was phonetically a vowel, it was coded in the vowel category. Cross-tabulations between non-sibilant fricatives and following phonetic segment revealed that before following labio-dental [f][14] /t,d/ was retained at a rate of 45%. Before following /v/ the variable

[13] The term spirant, here, refers to non-sibilant fricatives only.
[14] 80 out of the 147pre-[f] tokens were deleted.

sporadically occurred and the deletion rule did not apply. Hence, among non-sibilant fricatives, following /h/ plays a notable role in disfavouring deletion, as 84% retention occurred before following [h] (e.g. *stand here*)[15], and even more retention (95%) was found when the following /h/ was dropped (see section 4.4 for the behaviour of non-sibilant fricatives and following /h/ in the three locations separately analysed). This result might be due to the *open glottal* constriction of /h/, compared to the *close oral* constriction of other following consonants which inhibit /t,d/, as also claimed by Temple (2009), hence /h/ patterns like vowels.

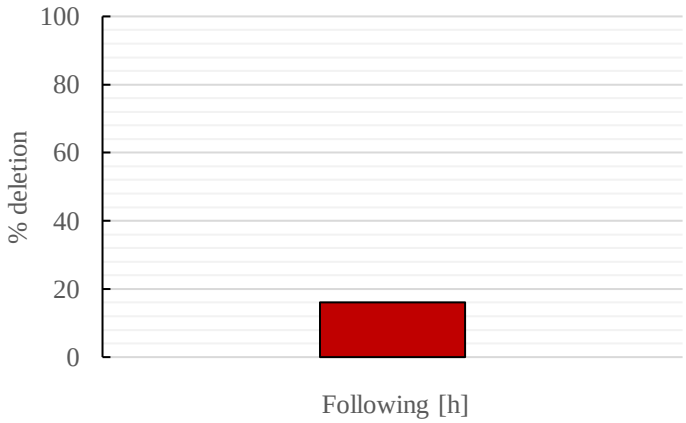


Figure 4.4.3 Rates of deletion before following [h].

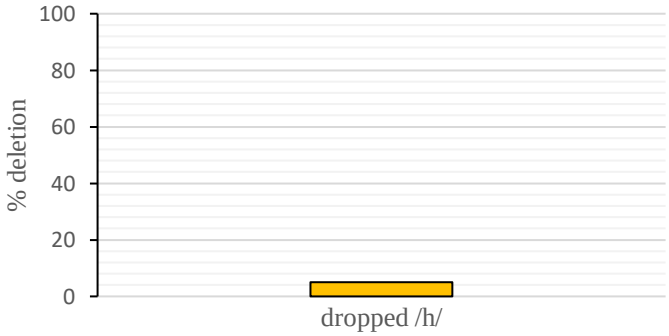


Figure 4.4.4 Rates of deletion before dropped /h/.

[15] Only 28 of the 179 tokens of pre-consonantal [h] were deleted.

If this finding is consistent across the three East Anglian locations, it will reveal new phonological insights into the following environment for (t,d).

The third favouring predictor, in order or ranking, is represented by stops (.69). Even though these factors (nasals, stops and sibilants) are treated separately in this analysis, these findings seem to match the literature as the obstruent category has constantly highly influenced deletion and so do nasals. So far, what stands out in this category is that non-sibilant fricatives strongly disfavour deletion.

The approximants /l/ and /r/, in line with previous research, behave differently in the East Anglian dataset. The lateral shows a value of deletion equal to .535, whilst the rhotic consonant disfavours at a rate of .418. This distinction, as suggested by Guy (1991), can be explained by the resyllabification process according to which final stops may resyllabify onto the following segment as in *went round*, where final /t/ is more likely to retain since English allows for the following syllable onsets /tr-/ and /dr-/. On the contrary, */tl-/ and */dl-/ are prohibited in all English varieties[16]. However, results from the York data (Tagliamonte & Temple, 2005) is not consistent with the resyllabification explanation as all consonants were found to favour deletion except for /l/ (.50), being in a neutral position. This finding might be linked to the clearness/darkness of /l/ (further details will be provided later in the Chapter).

Glides, which divide /l/ and /r/ in the hierarchy, along with vowels and pause are marked as disfavouring factors. As shown in the previous Chapter, the effect of following pause is "open to dialect-differentiation" (Labov, 1989: 90) and it is usually referred to as an arbitrary factor (Patrick, 1991). In New York City (Guy, 1980),

[16] Due to the similarity of /l/ with other consonants, in making unacceptable syllable onsets following /t/ or /d/, laterals and the other consonants have been grouped in a single factor in some studies on (t,d) (e.g. Jamaican Creole), whilst rhotics were treated separately (Patrick, 1999). In Manchester, both laterals and rhotics have been merged in the consonant category (Baranowski & Turton, 2020).

Jamaican Creole (Patrick, 1991), Tejano English (Bayley, 1994) and Manchester (Baranowski & Turton, 2020) following pause boosted /t,d/ deletion more than following vowels[17]. In other southern and southwestern US dialects (Santa Ana, 1996), in Philadelphia (Guy 1980; Tamminga 2016), York (Tagliamonte & Temple, 2005) and in East Anglia, instead, pause behaved like a vowel in promoting retention.

In terms of sonority, Guy (1991) claims that the less sonorous a following segment is, the higher the reduction of the coronal stop. However, in East Anglia, the sonority effect does not surface for the following environment despite glides and vowels showing lower rates of deletion.

4.4.2 Voicing agreement

The second most powerful constraint in the regression analysis is agreement in voicing of the segments preceding /t,d/. According to Wolfram (1969), English is governed by a rule by which the second member of a consonant cluster can be deleted provided that the second member is a plosive and that both members agree in voicing. Indeed, typical findings show more deletion in homovoiced tokens than in heterovoiced ones (Labov 1989; Bayley 1994). However, in the East Anglian dataset the reverse occurs: heterovoiced tokens (e.g. *bolt*) promote deletion, yet homovoiced tokens (e.g. *bold*) disfavour it. Heterovoiced tokens make up only 18% of the data but are deleted at a much higher rate (64%), as opposed to 17% deletion for homovoiced tokens. This scenario does not change even when glottal variants are included in the dataset, indeed heterovoiced tokens remain the most favouring predictor (see section 4.3). The question is: why?

[17] Even though following pause boosted deletion more than vowels, they were both statistically disfavouring predictors in Manchester.

To begin further investigation let us zoom into this factor group. Recall that Johnson & Amos (2016) suggested to split the (t,d) variable in British English, since /t/ and /d/ do not share the same distribution in word-final clusters. Along this line, the East Anglian dataset was split and /t/ and /d/ were treated separately for a careful consideration of this unconventional finding. However, splitting the dataset is not going to help as the only data for /d/ are two irregular devoicing tokens.

Turning to the analysis of /t/ only, heterovoiced was marked as disfavouring predictor even though the deletion rate is much higher[18]. Possible linguistic explanations could be due to (a) interaction with preceding phonetic segment or (b) interaction with morphological class if nearly all heterovoiced tokens are monomorphemes. The /t/ dataset was reanalysed again excluding the preceding context[19]. Results finally show that heterovoiced tokens strongly favour deletion. Hence, this unconventional finding springs from interaction with the preceding environment. Crosstabulations revealed that 70% of heterovoiced tokens are preceded by nasals, whilst 29.5% are preceded by laterals.

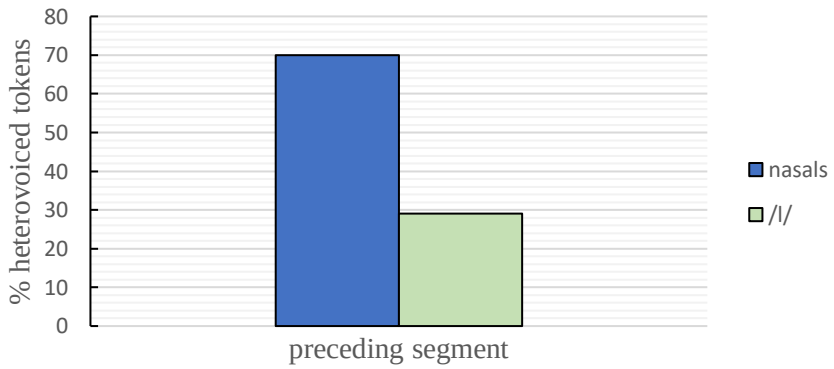


Figure 4.4.5 Heterovoiced tokens in the preceding segment.

[18] The deletion rate of disfavouring heterovoiced is 64%, whereas it is 19% for favouring homovoiced. Note that the Variance Inflection factor (VIF) was high in this run. VIF quantifies multicollinearity in the regression analysis.

[19] Additional analysis was then conducted including the preceding environment and excluding morphological class, yet this run turned out not to be significant.

Even though the lateral's rate of deletion is also relevant, the effect of /l/ goes in the right direction disfavouring the word-final simplification. Thus, the prime issue for this constraint remains preceding nasals. Further investigation shows that in the /t/-analysis all preceding nasals (n = 794) are also included in the hetero-tokens category (n = 887), therefore there is massive overlap and the condition of orthogonality is not fulfilled. It is claimed that to achieve an accurate analysis, factor groups must be 'orthogonal' i.e. there must be minimal overlap between them (Clark & Trousdale, 2013).

4.4.3 Style-shifting

The third significant predictor in the mixed-effects regression analysis is style-shifting. Results show consistency in the literature with more (t,d) absence in spontaneous speech than in reading style (Labov, 1967). To account for stylistic variation in the present study, (t,d) deletion is investigated in spontaneous speech, reading passages and word lists. Figure 4.4.6 illustrates a linear effect for the East Anglian pattern.

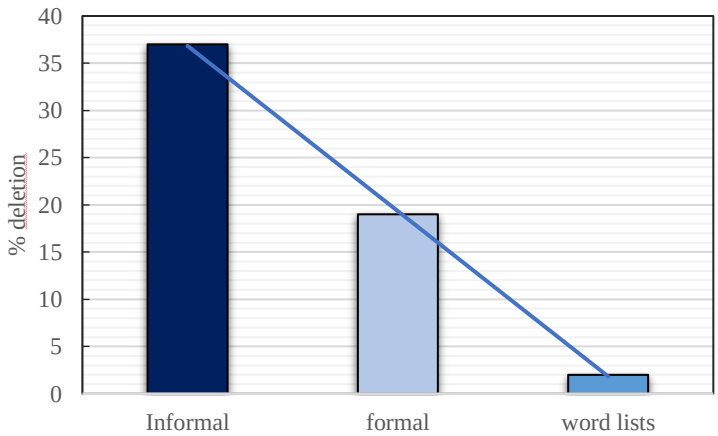


Figure 4.4.6 Rates of deletion across different speech styles.

Typically, the literature suggests that individuals are able to differentiate monomorphemes from regular past tense verbs only in careful speech (Roberts, 1994). Figure 4.4.7 illustrating crosstabulations between style and morphological class, reveals that East Anglian speakers largely delete /t,d/ in negative contractions (e.g. *don't*) in both spontaneous speech and reading styles. Comparably, in both styles, lower deletion rates occur among monomorphemes; however, /t,d/ is categorically retained when monomorphemes and *n't* tokens are realised in isolation (i.e. word lists). More deletion occurred among semiweaks in the spontaneous speech, whilst reading styles and word lists show a lower incidence of (t,d) absence. Noticeably, low rates of /t,d/ absence were found among regular verbs, where 5% of deletion surfaced in word lists.

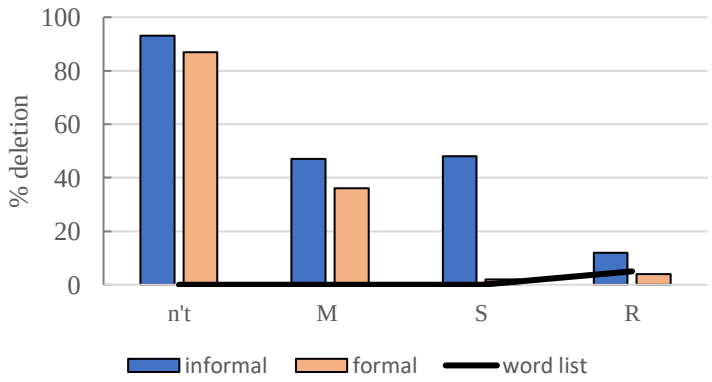


Figure 4.4.7 (t,d) deletion by style and morphological class.

These findings align with the classical approach to sociolinguistic style according to which individuals eschew non-standard forms (e.g. (t,d) deletion) as their level of awareness increases (e.g. in reading styles and word lists). Similar findings are reported in Manchester, with more deletion in spontaneous speech than in careful style (Baranowski & Turton, 2020). Purse's (2019) Electro-Magnetic Articulography (EMA) study, however, shows that speakers produced the least tongue tip raising in word list tasks.

4.4.4 Morphological Class

The fourth significant predictor is the morphological class (Ciancia & Patrick, 2019). In order to shed light on the unsolved problem of morphological effect in British English dialects a crucial comparison with previous British studies is needed. In Chapter 3 we came across the conflicting results between York (Tagliamonte & Temple, 2005), Manchester (Baranowski & Turton, 2020), and Tyneside English (Woolford, 2018). In York, morphological class failed to reach statistical significance; conversely, Manchester and Newcastle exhibit the usual 'robust morphological effect' with more deletion in monomorphemes (e.g. *mist*) than inflected forms (e.g. *missed*).

Group results. The following graph, matching the North American pattern, shows that East Anglian speakers are more likely to delete /-t,d/ from negative contractions (e.g. *can't*) and monomorphemes (e.g. *mist*) than semi-weak (e.g. *left*) and regular past tense verbs (e.g. *called*), yielding the following ranking:

n't > monomorphemes > semi-weak verbs > regular past tense verbs.

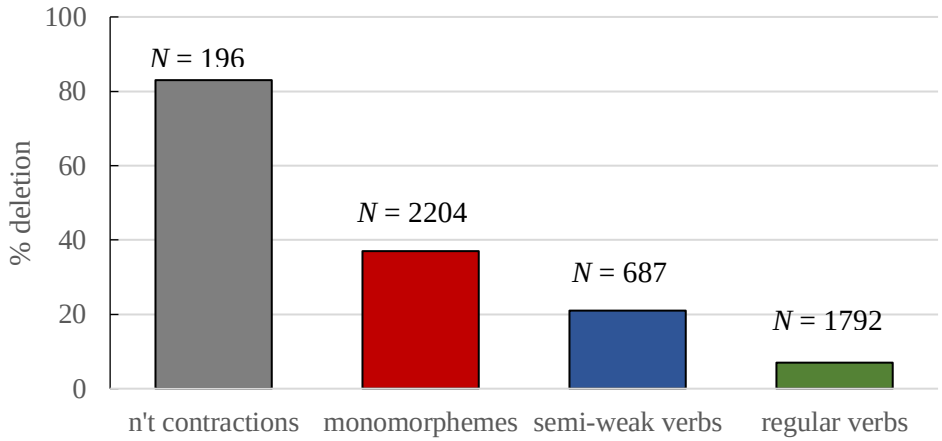


Figure 4.4.8 Deletion rates by morphological class.

It is worth-noting that, despite the low number of tokens, negative contractions are the most favouring predictor, similar to Jamaican Creole where /t,d/ was found to be deleted at a rate of 87% (Patrick, 1999). Patrick (1999) emphasises that *n't* clusters generally show the highest rates of (TD)-absence of any morphological class. King of Prussia's informants were also found to exhibit a greater deletion rate variance across speakers in negative {n't} (Labov, 1989). However, few studies took into account *n't* morphemes. These tokens were also included in the Tejano English study (Bayley, 1994), yet they are only mentioned in the preceding phonological segment to evince that a sonority hierarchy which governs (t,d) is less compelling. Labov (1986) excluded both [nt] and [nd] tokens as considered "hard to tabulate" owing to the nasal flap formation rule in which the stop feature is realised by a flap holding characteristics of nasality. Negative {n't} tokens have also been removed from both the York (Tagliamonte & Temple, 2005) and Manchester (Baranowski & Turton, 2020) studies. Along the line of Patrick (1999), I believe that it is worth considering this morphological category in order to account for a thorough morphological effect and to control for the sonority hierarchy of the preceding phonetic segment. When comparing the East Anglian morphological effect with that of York and Manchester, *n't* tokens were excluded from the analysis, yet the monomorpheme (M) factor group still remains a favouring predictor at .61; semi-weak verbs (S) favour at .54, whereas regular verbs (R) resist deletion at .35.

Morphological class				
Factor	**logodds**	**Tokens**	**%**	**FW**
M	0.464	2204	37	0.614
S	0.173	687	21	0.543
R	-0.636	1792	7	0.346

Table 4.4.3 Regression analysis of morphological class.

The coding procedure for monomorphemes in previous studies includes strong preterites (e.g. *went*) and replacive verbs (e.g. *sent*) "under the assumption that such verbs fulfil the structural description of -t,-d deletion from the earliest lexical insertion" (Guy, 1991: 20).

The lexical phonology model which has strengthened the theoretical framework of the (t,d) variable rule claims that all morphological processes and many morphological ones are carried out in the lexicon. This theory suggests that different types of morphological processes operate at two ordered levels within the lexicon: irregular inflections are found at level one, whilst regular inflectional affixes occur at level two. "A form must pass through all levels before surfacing" (Guy, 1991: 6). Thus:

a. **Monomorphemes**

   The underlying /t,d/ in monomorphemes exists from the earliest stage of lexical insertion; e.g. *raft, cold.*

b. **Semi-weak verbs**

   The semi-weak class is treated as undergoing affixation at level one owing to the stem vowel change; e.g. *kept, told.*

c. **Regular past tense verbs**

   In regular past verbs, /t,d/ are inserted at level two of the lexicon (Guy, 1991); e.g. *missed, called*.

In York, suppletive forms (e.g. *found*), replacive forms (e.g. *sent*) and preterite *went*[20] were coded separately (Tagliamonte & Temple, 2005), whilst they were all coded together with semi-weak verbs in the East Anglian study. However, the East Anglian dataset exhibits a low number of tokens for the above categories: *found* (n = 12), *sent* (n = 12) and *went* (n =25). It is unlikely that the exclusion or reclassification of these

[20] In note 12, Tagliamonte & Temple (2005) note that a high number of *went* tokens were realised with glottal stop or were glottalized (45%), hence they suggest that it should be treated separately. In the East Anglian dataset, however, tokens realised with final /t/-glottaling/glottalization were excluded from analysis.

inflectional forms would have an effect on the statistical significance for this constraint, given the high number of tokens in the four morphological categories. Indeed, the strong morphological effect does not disappear when preterite *went* is excluded from the analysis.

Comparison with York and Manchester. Deletion in the monomorpheme category is higher in all three studies, whilst semi-weak verbs nearly pattern with regular verbs in both York and Manchester[21]. In East Anglia, instead, there is a strong linear effect when all styles are taken into account.[22]

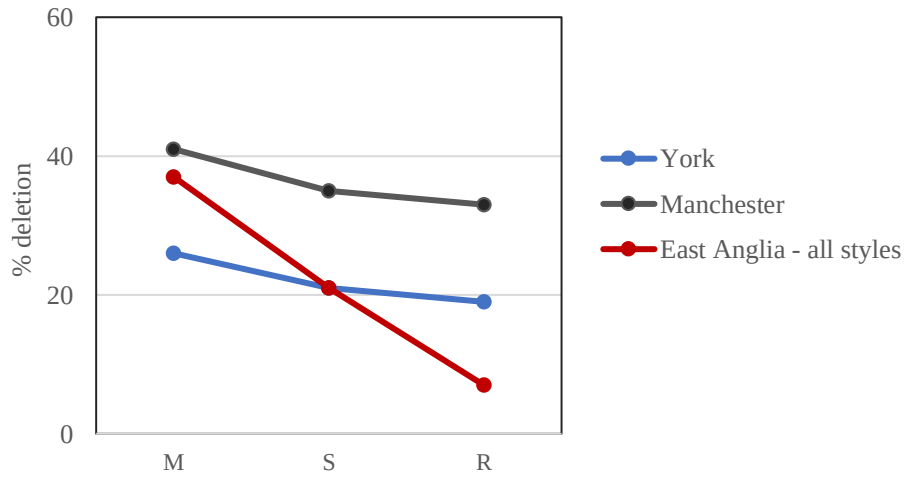


Figure 4.4.9 Rates of deletion by morphological class in East Anglia, York and Manchester.M = monomorphemes, S = Semi-weak verbs, R = Regular past verbs.

Baranowski & Turton (2016) discussed earlier findings from Manchester under the theory of the lifecycle of phonological processes (Bermúdez-Otero 2007, 2015). This theory, which is associated with phonological change and models the development of phonological features over time, suggests that a phonological process initially applies

[21] Note that morphological class, in York, was not marked as a significant predictor.
[22] When only spontaneous speech is taken into account (including glottal variants) rates of deletion for monomorphemes (44%) and semi-weak verbs (37%) are slightly higher than Manchester, whereas deletion rates for regular verbs (13%) are lower than the two northern studies.

at lower levels of the grammar, i.e. at the word level,[23] as its access to the morphological structure is blocked. This suggests that, over time, this process may apply to the stem level, affecting only monomorphemes, since the stem level does not have access to the regular past tense affixes and, consequently, they do not undergo (t,d) deletion. They also suggest that the strong morphological effect which is commonly found across US English varieties may be due to the maximum rates at stem level reached by US individuals. Thus, the British pattern would suggest that Britain is behind the US in terms of stem-level as also suggested by Woolford (2018) for Tyneside English.

Comparatively, levels of deletion in East Anglia are lower than Manchester and even lower than York, except for monomorphemes. Viewed through the lens of the above theory, it could be assumed that (t,d) deletion is at an early point in East Anglia, suggesting that it has already been applying at a stem level and that, probably, it will not go to much higher overall levels if it only applies at its maximum rate late in change. One of the core claims of life cycle theory is that some phonological processes merge with morpho-syntax as they age[24]. This approach appears to apply to changes in progress across a speech community, as opposed to e.g. Guy & Boyd's findings which manifest an age-grading process across the individual lifespan. However, results from East Anglia take us to a direction which is opposite to that of a change in progress, as age was not marked as a significant predictor, indeed all three age groups delete /t,d/ at the same rate.

The semi-weak class was traditionally considered an intermediate category, even though some speakers treat them as monomorphemes, others as regular past tense verbs (Guy & Boyd, 1990). Despite being a disfavouring predictor in East Anglia, the

[23] In this case *mist* and *missed* would be affected at the same rate.

[24] This links to Bybee's (2002) assumption of a change in progress as discussed in section 3.3.5. It is worth noting, though, that social factors do not show significant conditioning of (t,d) in Manchester (Baranowski & Turton, 2020), but they do in Tyneside English (Woolford, 2018).

deletion rate of semi-weak verbs is closer to that of monomorphemes than regular verbs. Indeed, when negative {n't} tokens were excluded from analysis, results showed a positive correlation between semi-weak verbs and monomorphemes. However, given the gap between the two predictors, the semi-weak class could be considered an intermediate category (see table 4.4.3). Fruehwald (2012: 85) argues that semi-weak verbs and regular past tenses should be treated "as being identical in terms of phonological deletion and differing in morphological realisation." Under a *Competing Grammars* approach to variation, as outlined in Chapter 3, Fruehwald (ibid) suggests that there is morphological variation in the semi-weak class. Along this line, he claims that there are two processes to reach the surface form [kɛp]: (i) morphological absence of /t/; (ii) phonological deletion of /t/ which was morphologically present. Fruehwald (ibid), in the Buckeye Corpus, found young speakers to delete near categorically in the semi-weak category; whilst Patrick (1999) found a distinctly higher rate of (t,d) absence in regular past verbs in JC. This result from Jamaica Creole is due to an additional intervening process, known as morphological variation. In East Anglia, however, the measurement of morphological presence in semiweaks according to the formula below (as in Fruehwald, 2012):

$$\frac{\text{Observed Semiweak (t,d) presence}}{\text{Regular past (t,d) presence}}$$

reveals the following result: 0.786/0.929 = 0.846% of morphological presence. This suggests a low rate of morphological absence (i.e. non-marking of past tense). To the extent it occurs, it may be due to adult speakers who have never realised semi-weak verbs as a distinct category and/or do not categorically inflect them.

The exponential model – an explanatory factor for the morphological effect for some English dialects (see Guy, 1991) – does not hold for the East Anglian data. While Guy's (1991) values obtained from monomorphemes and regular past tense verbs are

very close[25] and confirm his hypothesis, in East Anglia the estimated value of p_r (probability of retention) for monomorphemes is comparatively lower than that of regular verbs, as illustrated in the table to follow:

Morphological class	Rate of retention	Estimated value of p_r
Monomorphemic	0.629	0.856 (cube root of surface rate)
Semiweak past	0.786	0.886 (square root of surface rate)
Regular past	0.929	0.929

Table 4.4.4 Estimates of the value of pr in the East Anglian dataset.

Why do monomorphemes show a smaller value of p_r? Could word-frequency potentially affect this outcome? Usually, monomorphemes are subject to a notable deletion rate, hence it would be expected that rates of retention are lower in both high and low frequency words. A crosstabulation between morphological class and frequency of words[26] reveals that rates of retention are lower among frequent monomorphemes than among infrequent ones.

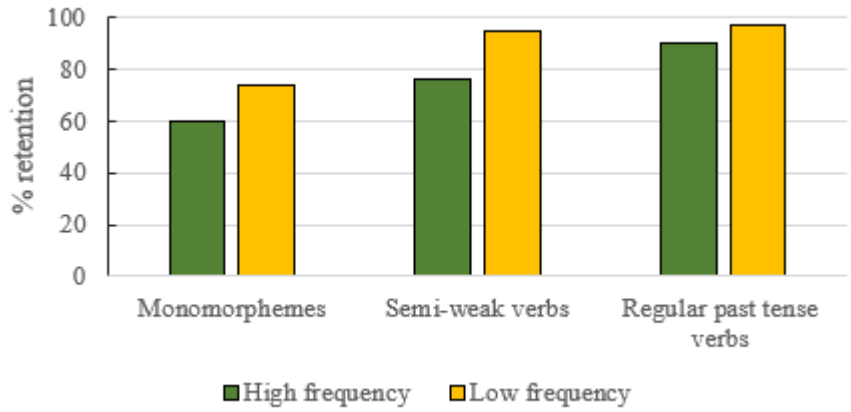


Figure 4.4.10 Rates of retention by morphological class and word-frequency.

[25] .914 and .918, respectively in adult speakers.
[26] As mentioned in Chapter 2, values 1-3, in the SUBTLEX-UK corpus, represent low frequency words, whereas values 4 -7 represent high frequency ones.

Inter-speaker variation. If there is a pan-English effect, speaker differences should show consistent range across categories. In East Anglia, the degree of inter-speaker variation is clustered for monomorphemes and regular past verbs as in the figure below, however there is inter-speaker dispersion for semi-weak verbs.

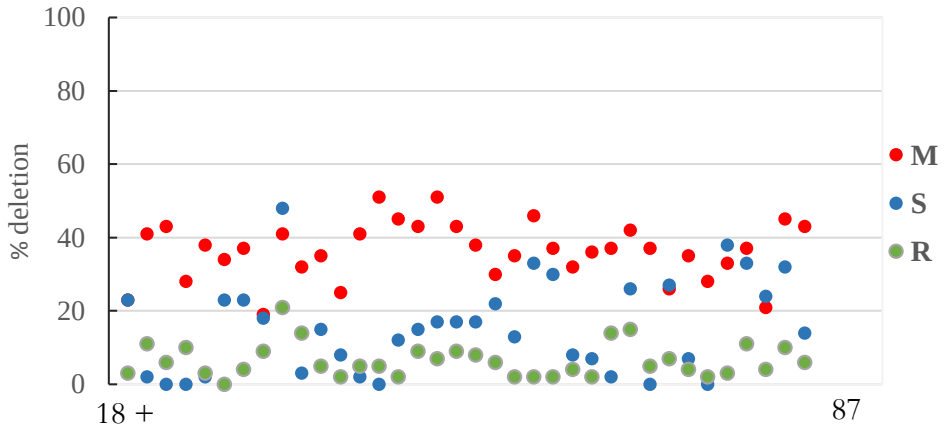


Figure 4.4.11 Morphological class by individual speakers' age.

Figure 4.4.12 also includes individual speakers' age, yet there seems to be no pattern opposing young speakers to older speakers (Ciancia & Patrick, 2019).

The variability within the semi-weak class motivated Guy & Boyd (1990) to study the effect of age demonstrating that children are all tightly clustered with high probabilities of /t,d/ deletion in the semi weak class, but as they get older they treat semi weak verbs as bimorphemic – a pattern consistent with age-grading. However, Guy & Boyd's (1990) findings cannot be replicated in the present study as the East Anglian sample does not include any children.

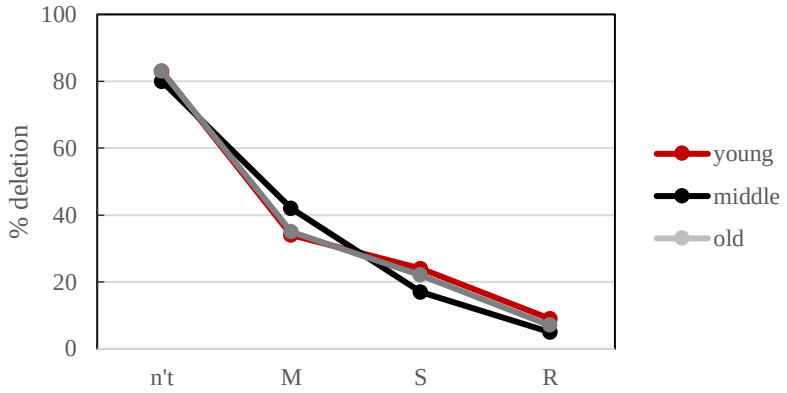


Figure 4.4.12 Interaction between morphological class and age, ($p < 0.01$).

4.4.5 Preceding segment

In the North American English literature, the preceding phonetic segment has usually a weak effect on the application of (t,d) deletion, and it is commonly referred to as a "tertiary constraint" (Guy, 1980: 20)[27]. However, in York (Tagliamonte & Temple, 2005) its effect is far stronger than the morphological one. Similarly, Sonderegger et al. (2011) claim that once the preceding environment is included in the model, morphological class falls out.

Group results. The East Anglian pattern resembles North American English dialects in the statistical significance of this constraint and in its weak effect on the response but differs in its phonetic conditioning. While the literature reports the typical following ranking with more deletion after a preceding alveolar fricative and least deletion after a preceding liquid:

/s/ > stops > nasals > other fricatives > liquids (Labov, 1989)

the East Anglian pattern exhibits more (t,d) absence after preceding nasals and less deletion after a preceding non-sibilant fricative, yielding the hierarchy:

[27] Santa Ana (1996), by contrast, reports factor weightings for the preceding environment as analogous to the morphological class and greater than the following phonological context for Chicano English.

nasal > sibilant fricatives > /l/ > stops > non-sibilant fricatives.

The high position of nasals does not line up with previous studies and does not change even when glottal variants are included in the dataset, as illustrated in the graph below.

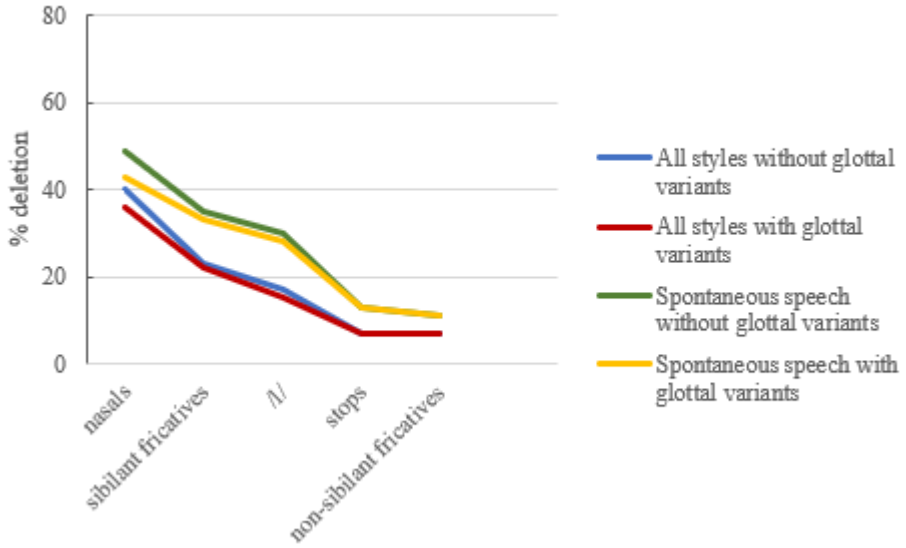


Figure 4.4.13 Preceding environment in East Anglia: comparison between different datasets

Labov et al. (1968) suggested that /t,d/ reduction after /s/ is governed by a separate rule which could explain the high position of sibilants in (1). This correlates with the theoretical sonority predictions, whereby the conventional expectation would be: less sonorous preceding segments favour deletion (e.g. stops and fricatives), whilst more sonorous preceding segments disfavour it (e.g. nasals)[28] (Santa Ana, 1991). However, the sonority hierarchy does not hold for the East Anglian pattern as the findings go in a direction opposite to the usual claim. Indeed, nasals greatly influence the /t,d/ simplification at .669, followed by sibilants (.616), whilst /l/, stops and non-sibilant

[28] Note that Santa Ana (1991) treated preceding liquids as exceptions and concluded that, in Chicano English, preconsonantal /l/ is less resonant than General American English /l/. Hence it is attributed a "lower sonority value to ChE /l/ less than to certain fricatives".

fricatives have a negative effect and disfavour at .447, .412 and .353, respectively. The association of increased sonority with increased deletion was also reported in Chicano English (Santa Ana, 1991), and in African American Vernacular English (Patrick et al., 1996) where preceding /l/ was the most highly influential phonetic segment. This negative effect of the sonority hierarchy in East Anglia seems to hold for both York and Manchester too, due to the high place of resonants and the low position of less sonorous segments:

(1) York (Tagliamonte & Temple, 2005)
sibilants > liquids > nasal > stops > fricatives

(3) Manchester (Baranowski & Turton, 2020)
sibilants > affricate > nasal > stop > fricative > lateral

Thus, in the light of these findings, (t,d) seems not to be governed by a sonority hierarchy in British English. By contrast, a closer correlation with the theoretical sonority hierarchy was found in Jamaican Creole (Patrick, 1999), where phonetic environments in (1) are re-ordered:

sibilants > stops > fricatives > nasals > lateral.

This exchanging of place between nasals and fricatives "unites the two natural classes of segments, which are neighbours in the sonority hierarchy" (Patrick, 1999: 144).

The high position of nasals and sibilant fricatives in the East Anglian ranking (2) is predicted by the Obligatory Contour Principle (OCP, Goldsmith, 1976), as discussed by Guy & Boberg (1997), whereby preceding segments trigger the absence of the final coronal stop if they share two or more features. Along the line of autosegmental phonology, the features shared with the target variable differ among the nasals /m/, /ŋ/ and /n/: /m, ŋ/ share only [-cont]; /n/ shares [+cor, -cont]. Hence, a preceding /n/ is

more likely to favour deletion. However, in the present study, due to the low number of tokens in the preceding /m/ environment (e.g. *dreamt*), all nasals were combined[29]. The second most favouring segment in the hierarchy is represented by sibilant fricatives, which share the features [+cor, -son]. What is surprising, under this approach, is the high place of /l/ which precedes stops in the ranking. If adjacent identical segments and features are prohibited, then preceding stops [-son, -cont] would create OCP clashes more than preceding /l/, which shares with /t,d/ only the [+cor] feature. Non-sibilant fricatives, as expected, are the least environment to favour deletion being identical with the target variable only in the [-son] feature.

Comparision with York and Manchester. Figure 4.4.14 compares results from East Anglia with York and Manchester's findings.

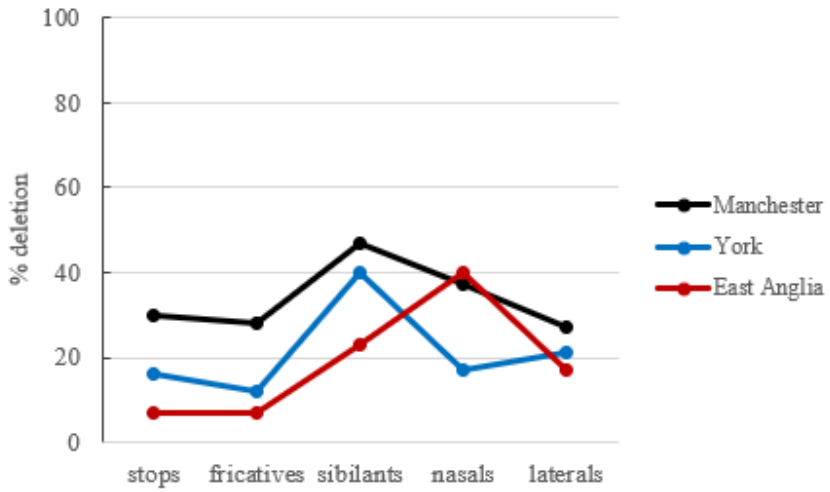


Figure 4.4.14 Rates of deletion according to the preceding environment in East Anglia, York, and Manchester.

[29] The number of tokens with preceding /m/ equals to 93, whilst tokens with preceding /n/ are equal to 1909.

Both stops and fricatives show low rates of deletion, and notably higher rates of deletion after sibilants, with East Anglia resembling York. Yet, after nasals East Anglia resembles Manchester. As discussed above, in East Anglia, the behaviour of preceding /l/ and stops is not consistent in terms of the OCP. In York, however, not only is the probability of deletion parallel between /l/ (.43) and stops (.43), but they are also comparable to the behaviour of nasals (.45)[30]. Temple (2009) points out that high deletion rates with a preceding /n/ and /s/, such as in East Anglia and Manchester, might be due to the homorganic place of articulation with the final coronal stop.

4.4.6 Non-significant predictors – Overall Results

When reporting statistical results, it is suggested that "all independent variables tested should be reported, whether significant or not. Non-significance of a potential predictor is an important finding" (Guy, 2018). Along this line, this section presents results from Rbrul one-level analysis to explore additional independent variables included in the model with the hypothesis that they might have an effect on the response, but which were not marked as significant predictors (see Appendix I for further details).

Fasold (1972), Wolfram (1972), Labov (1989), Bayley (1994)[31], and Roberts (1994) found that (t,d) deletion is more likely to occur in unstressed syllables than in stressed ones. In the present study, even though the findings are in the right direction from what we would expect, this predictor failed to reach statistical significance, similar to Tejano English (Bayley, 1994). Moreover, social factors such as sex, age and class do not exhibit significant conditioning of (t,d) deletion.

[30] These are probabilities; however, percentages differ more.

[31] In this case, I refer to the results of adult speakers, where unstressed syllables undergo (t,d) deletion at a rate of 51%, whilst in unstressed syllables the word final cluster reduction is less likely to occur (34%). Results among young Tejanos, instead, go in the opposite direction.

In East Anglia, males delete slightly more than females; working class speakers do not delete considerably more than middle class members with a rate of 27% and 25%, respectively, and all age-groups exhibit (t,d) absence at the same rate. In view of these findings, the profile of (t,d), in East Anglia, is that of a stable variable.

Location does not surface as a conditioning predictor of /t,d/, and the effect of locality depends on the level of other predictors as shown in section 4.5.4, where the interaction between locality and other predictors will be discussed.

Since phonetic reduction is also highly conditioned by word frequency, this predictor was initially included in the model with the hypothesis that deletion occurs more in high-frequency words than in low frequency ones (Bybee 2002). However, the East Anglian database did not reveal a significant variation between low and high frequency words, hence this factor group was excluded post-coding. Figure 4.4.15 indicates the non-significant trend of word-token frequency, with more frequent words exhibiting a higher deletion rate. Overall, however, the lexical frequency of this database also shows high retention rates in both low and high frequency tokens.

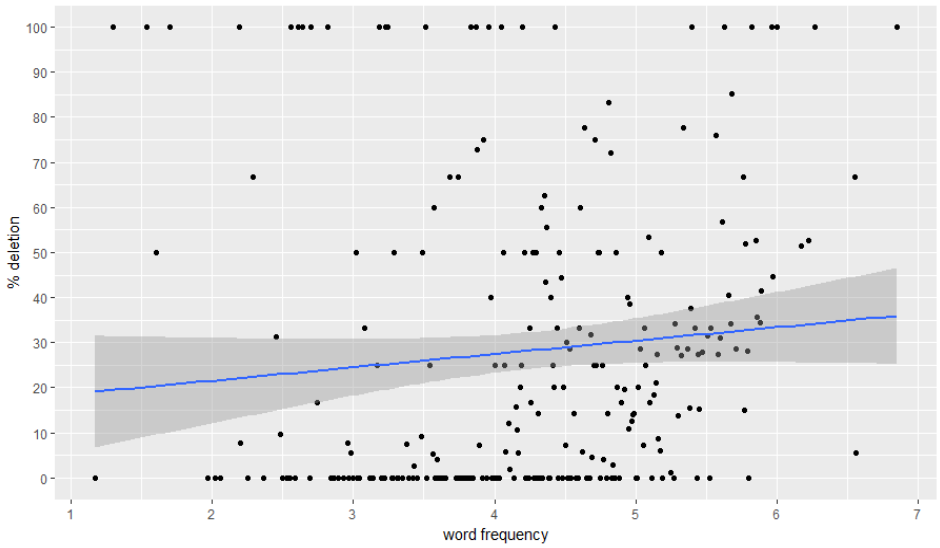


Figure 4.4.15 Word frequency from SUBTLEX-UK and percentages of deletion.

Purse & Tamminga (2019), as outlined in chapter 3, take a different view on lexical frequency and argue that previous invisible significance of frequency effects emerges if lexical frequency is measured by Root frequency.

So far, we have discussed results from the three combined East Anglian locations.

Let us now analyse Colchester, Ipswich and Norwich separately to explore whether the linguistic and social constraints indicate consistency across the urban areas.

4.5 Treating Colchester, Ipswich and Norwich separately

The overall results revealed a contrastive behaviour between sibilant fricatives and non-sibilant fricatives in the following environment, with non-sibilants disfavouring deletion mostly due to following retained [h]. If location is not a necessary predictor for (t,d) since constraints across the English dialects are parallel, with the exception of following pause, as evinced in the literature (Labov, 1989), we should expect all linguistic constraints – including the different behaviour of sibilant fricatives and non-sibilant fricatives as well as the role of following /h/ - to be consistent across the three localities examined. Colchester, Ipswich and Norwich will be singly analysed, in this section, and the dataset will be split accordingly. Firstly, I will show how each locality patterns with the overall East Anglian findings; secondly, results will be theoretically discussed, and finally I will show the interactions between locality and other predictors.

4.5.1 Results from Colchester

Table 4.5.1 indicated results of a step-up/step-down regression analysis, with speaker as a random effect, showing that following phonetic segment, voicing agreement, style, morphological class and preceding phonetic segment have a significant conditioning of (t,d).

Following environment. Analogous to the overall findings, following nasals trigger deletion the most (.812), followed by sibilant fricatives which favour at .768; liquids do not behave differently in Colchester, indeed table 4.5.1 suggests that both /l/ and /r/ affect the word-final cluster reduction at .698 and .672, respectively. This variable is also significantly affected by a following stop (.672) with the same weight as a following /r/. On the contrary, glides (.389), non-sibilant fricatives (.343), vowels (.187) and pause (.112) disfavour deletion. Among non-sibilant fricatives, the remarkable role of /h/ is confirmed since the high /t,d/ **retention** is due to following underlyingly consonantal [h]. These findings resemble the overall East Anglian pattern, illustrated in (3), except for liquids.

(3) *East Anglian pattern*:
nasals > sibilants > stops > /l/ > glides > /r/ > non-sibilant fricatives > vowels > pause

(4) *Colchester:*
nasals > sibilants > /l/ > /r/ > stops > glides > non-sibilant fricatives > vowels > pause.

Why do liquids behave differently with respect to the East Anglian pattern? The deletion rate before a following /l/ (71%) is higher compared to the rates of (t,d) absence before a following /r/ (41%; though the factor weights are quite close, above). This suggests that resyllabification does not provide an explanation that holds for the Colchester data.

This could be due to: (a) the relatively low number of tokens in these categories, indicated in table 4.5.1[32] (b) clearness/darkness of onset /l/ (e.g *LEAF*).

[32] When the three locations are combined the dataset shows 81 occurrences before a following /r/ and 44 tokens before a following /l/. In York, however, the number of tokens in the following /r/ and following /l/ contexts is lower and equals to 32 and 26 occurrences, respectively.

Following (b), Baranowski & Turton (2016) suggest that the place of articulation of a following /l/ may play a notable role. That is, in varieties which exhibit dark initial /l/s, such as Manchester and American dialects, the tongue tip gesture is missing or delayed thus /-t,d/ is more likely to be deleted owing to the lack of coronal place.

This explanation might account for the relatively higher deletion before laterals in Colchester and perhaps Ipswich, compared to Norwich where at least post-vocalic /l/ has a history of being clear after high front vowels (Trudgill 1974). Johnson & Britain (2007: 299) note for northern East Anglia, "/l/ was clear in all positions… well into the 20th century".

Voicing agreement. The second significant predictor in the regression analysis is voicing agreement. The reversed and unexpected finding, as discussed in 4.4.2, holds for Colchester with heterovoiced tokens favouring the cluster simplification at .763, and homovoiced tokens disfavouring at .237.

Style. Style is the third predictor to affect this variable, with a notable reduction in spontaneous speech (.793), whilst in reading passages and word lists the apical stops are more likely to be retained, indeed they disfavour deletion at .499 and .208, respectively.

Application value = deletion; overall proportion = 0.263				
R^2 = 0.667; log likelihood = -536.001; *N* =1615				
Constraints	**Logodds**	**FW**	**%**	**Tokens**
Following Env. p<.001				
nasals	1.463	0.812	71	56
sibilant fricatives	1.197	0.768	77	77
/l/	0.838	0.698	71	17
/r/	0.715	0.672	41	22
Stops	0.431	0.672	55	136
glides	-0.452	0.389	40	94
non-sibilant fricatives	-0.649	0.343	33	110
vowels	-1.471	0.187	20	470
pause	-2.072	0.112	10	633
Voicing agreement p<.001				
heterovoiced	1.172	0.763	60	309
homovoiced	-1.172	0.237	18	1306
Style p<.001				
spontaneous speech	1.340	0.793	38	893
reading styles	-0.003	0.499	19	375
word lists	-1.337	0.208	3	347
Morphological class p<.01				
n't contractions	0.766	0.683	77	66
monomorphemes	0.376	0.593	39	726
semi-weak verbs	-0.288	0.429	20	231
regular verbs	-0.854	0.299	8	592
Preceding Env. p<.01				
sibilant fricatives	0.594	0.644	28	419
nasals	0.493	0.621	38	684
/l/	0.205	0.551	20	93
non-sibilant fricatives	-0.158	0.461	11	179
Stops	-1.135	0.243	5	240

Table 4.5.1 Multivariate analysis of (t,d) deletion in Colchester.

Morphological class. The influence of morphological class, in Colchester, is consistent with the overall East Anglian results and matches the pan-English pattern: negative contractions favour deletion the most (.683) followed by monomorphemes (.593); whereas semi-weak verbs (.429) and regular past tense verbs (.30) exhibit a negative correlation.

Preceding environment. The last predictor which indicates a significant conditioning of (t,d) is the preceding phonetic segment. Differently from the overall findings, indicated in (5), in Colchester the greatest effect is contributed by sibilant fricatives (.644), followed by nasals (.621) and /l/ (.551). Consistently with the findings of previous studies, both non-sibilant fricatives and stops disfavour deletion.

(5) *East Anglian pattern:*
nasals > sibilant fricatives > /l/ > stops > non-sibilant fricatives

(6) *Colchester:*
sibilant fricatives > nasals > /l/ > non-sibilant fricatives > stops

Theoretically, the exchanging of position between nasals and sibilant fricatives on the one hand, and stops and non-sibilant fricatives on the other, seems not to be problematic with respect to the East Anglian pattern. In the first case, under the OCP approach, both sibilant fricatives and /n/ share two features with the target variable. Since the present study combines all nasals, this result could be justified if preceding /m/ triggered the most deletion. However, crosstabulations revealed that 59% of (t,d) absence occurs after a preceding /m/, whilst 81% of deletion was found after a preceding /n/. In the second case, even though both predictors are marked as disfavouring factors, deletion rates after non-sibilant fricatives are slightly higher than deletion rates after stops – a result which goes in a direction opposite to what the OCP predicts. Thus, taking also into account the high place of /l/, it appears that the OCP does not hold for the

Colchester data. With respect to sonority, despite the high position of sibilants in the hierarchy, it represents an obstacle to the theoretical sonority predictions reported by Santa Ana (1996).

4.5.2 Results from Ipswich

In Ipswich, the following context remains the strongest predictor for (t,d) deletion, whereas the interpretation in terms of sonority is not straightforward. Indeed, the high place of nasals in the hierarchy persists. Table 4.5.2 indicates results of a multivariate analysis with following phonetic context, voicing agreement, style, preceding phonetic context and morphological class marked as statistically significant factor groups.

Following environment. The greatest effect is provided by sibilant fricatives and nasals with no difference in probabilities (.832) following stops and following /l/ also favour deletion at .758 and .615, respectively, whereas glides (.481), non-sibilant fricatives (.392), vowels (.258), /r/ (.179) and pause (.153) strongly disfavour. The phonetic factors mirror the East Anglian pattern despite some slight ranking differences, indicated in (7). The divergent behaviour of sibilant fricatives and non-sibilant fricatives is repeated in Ipswich and, once again, following consonantal [h] highly contributes to the retention of /-t,d/.

(7) *East Anglian pattern:*

nasals > sibilants> stops > /l/ > glides > /r/ > non-sibilant fricatives > vowels > pause

(8) Ipswich:

sibilants > nasals > stops > /l/ > glides > non-sibilant fricatives > vowels > /r/ > pause

In section 4.5.1, we saw that, in Colchester, the magnitude of the liquids effect is nearly the same, with both /l/ and /r/ favouring deletion. By contrast, in Ipswich, liquids

behave as in previous empirical findings of North American dialects, with resyllabification as a possible explanatory factor.

Voicing Agreement. The reversed order of heterovoiced and homovoiced tokens also holds for Ipswich. The former favours deletion at .808, whilst the latter disfavours at .192.

Style. The third significant predictor of the multivariate analysis is style, with /-t,d/ being more likely to be simplified in spontaneous speech (.833) and reading styles (.625), than in word lists which exhibit a negative correlation (.107).

Preceding environment. In Ipswich, the effect of the preceding segment indicated in the regression analysis is slightly stronger than the morphological one. Nasals (.695) show the most deletion, followed by sibilant fricatives (.618) and stops (.601), where the difference in terms of factor weight is negligible. Preceding consonantal /l/ (.428) and non-sibilant fricatives (.194) disfavour deletion. These findings are consistent with the East Anglian pattern, despite the exchange of position between /l/ and stops, indicated in (10).

(9) *East Anglian pattern:*
nasals > sibilant fricatives > /l/ > stops > non-sibilant fricatives

(10) *Ipswich:*
nasals > sibilant fricatives > stops > /l/ > non-sibilant fricatives.

Application value = deletion; overall proportion = 0.26				
R^2 = 0.714; log likelihood = -518.733; *N* = 1658				
Constraints	**Logodds**	**FW**	**%**	**Tokens**
Following Env. p<.001				
sibilant fricatives	1.599	0.832	82	55
nasals	1.598	0.832	68	65
stops	1.141	0.758	58	133
/l/	0.469	0.615	64	14
glides	-0.076	0.481	42	101
non-sibilant fricatives	-0.439	0.392	29	123
vowels	-1.058	0.258	20	496
/r/	-1.521	0.179	27	26
pause	-1.712	0.153	11	645
Voicing Agreement p<.001				
heterovoiced	1.437	0.808	69	286
homovoiced	-1.437	0.192	17	1372
Style p<.001				
spontaneous speech	1.608	0.833	36	973
reading styles	0.509	0.625	21	353
word lists	-2.118	0.107	2	332
Preceding Env. p<.01				
nasals	0.825	0.695	42	695
sibilant fricatives	0.480	0.618	21	419
stops	0.410	0.601	10	257
/l/	-0.291	0.428	21	86
non-sibilant fricatives	-1.424	0.194	4	201
Morphological class p<.01				
n't contractions	0.435	0.607	82	70
semi-weak verbs	0.326	0.581	23	229
monomorphemes	0.197	0.549	37	750
regular verbs	-0.959	0.277	7	609

Table 4.5.2 Multivariate analysis of (t,d) deletion in Ipswich.

Theoretically, this reordering of stops and /l/, in the Ipswich pattern, is far from being problematic as it is in the direction predicted by the OCP: the more features are shared, the more likely it is that /-t,d/ will be simplified.

Morphological class. Similar to Colchester, *n't* negative contractions indicate the greatest effect on (t,d). However, the final model reports the following ranking:

n't contractions > semi-weak verbs > monomorphemes > regular verbs, with the latter being the only predictor to exhibit a negative correlation. Table 4.5.2 indicates that the factor weight of semi-weak verbs is .581, whereas the weight of monomorphemes equals .549. Why? Step-down analysis shows that when the preceding segment is dropped from the model monomorphemes and semi-weak verbs are reordered: n't > M > S > R, and they both favour deletion. Cross-tabulations showed that there is an interaction with the preceding environment. A closer inspection revealed that there is absence of tokens after preceding sibilant fricatives in the semi-weak category. With respect to the high place of semi-weak verbs, Tamminga & Fruehwald (2013) also report a greater deletion rate variance across speakers in semi-weaks than in monomorphemes (or regular past tense verbs) for the Buckeye corpus (Pitt et al., 2007). It is worth noting that, whatever the order, both monomorphemes and semi-weaks favour (t,d) deletion. Let us find out, in the following section, how (t,d) behaves in Norwich.

4.5.3 Results from Norwich

This section reports findings of a step-up/step-down regression analysis, with following phonetic segment, style, voicing agreement, preceding environment, morphological class and sex marked as statistically significant predictors.

Following environment. Nasals (.817) are the most favouring factor followed by sibilant fricatives (.813) which, once again, behave differently from their non-sibilant counterpart. Stops (.70) trigger the cluster simplification as well as following /r/ (.631). The latter, however, is inconsistent with the resyllabification theory and does not match the behaviour of /r/ in Ipswich, where the underlying liquid blocks the deletion of /t,d/ and it is in line with previous US English studies (e.g. Guy, 1980). Following /l/ (.22), by contrast, disfavours deletion along with non-sibilant fricatives (.497), glides (.389), pause (.218) and vowels (.204). The reversed behaviour of liquids in Norwich might be due to the clearness/darkness of onset /l/, that is: the coronal place of articulation of clear /l/ is suggested to favour retention of (t,d), as for York speakers, owing to the non-delayed tongue tip gesture (Baranowski & Turton, 2016).

Hence, the same explanation might account for Norwich, where at least post-vocalic /l/ has a history of being clear after high front vowels (Trudgill, 1974). Johnson & Britain (2007: 299) note for northern East Anglia, "/l/ was clear in all positions… well into the 20th century". Overall, these results mirror the East Anglian pattern, apart from the reversed behaviour of liquids and exchange of place between non-sibilant fricatives and glides.

(11) *East Anglian pattern*:

nasals > sibilants > stops > /l/ > glides > /r/ > non-sibilant fricatives > vowels > pause

(12) Norwich:

nasals > sibilants > stops > /r/ > non-sibilant fricatives > glides > /l/ > pause > vowels.

Style. Parallel to Colchester and Ipswich, /t/ and /d/ are more likely to be deleted in the spontaneous speech , which favours at .838, than in reading styles (.548) and word lists (.138).

Application value = deletion; overall proportion = 0.248 R^2 = 0.688; log likelihood = -497.504; *N* = 1606				
Constraints	**Logodds**	**FW**	**%**	**Tokens**
Following Env. p<.001				
nasals	1.493	0.817	57	76
sibilant fricatives	1.467	0.813	72	60
stops	0.849	0.7	55	155
/r/	0.535	0.631	24	33
non-sibilant fricatives	-0.012	0.497	35	110
glides	-0.450	0.389	38	103
/l/	-1.241	0.224	31	13
pause	-1.278	0.218	11	617
vowels	-1.364	0.204	16	439
Style p<.001				
infomal	1.641	0.838	37	844
reading passages	0.193	0.548	19	403
word lists	-1.835	0.138	2	359
Voicing Agreement p<.001				
heterovoiced	1.157	0.761	65	294
homovoiced	-1.157	0.239	16	1312
Preceding Env. p<.001				
nasals	0.916	0.714	43	624
sibilant fricatives	0.493	0.621	22	388
/l/	-0.316	0.422	13	178
non-sibilant fricatives	-0.455	0.388	8	185
stops	-0.638	0.346	5	231
Morphological class p<.001				
n't contractions	1.347	0.794	92	60
monomorphemes	-0.146	0.464	35	728
semi weak verbs	-0.280	0.431	22	227
regular verbs	-0.922	0.285	6	591
Sex p<.01				
males	0.36	0.589	29	803
females	-0.36	0.411	21	803

Table 4.5.3 Multivariate analysis of (t,d) deletion in Norwich.

Voicing agreement. The previously discussed unconventional finding, which is due to interaction with the preceding phonetic segment (see section 4.4.2), also holds for Norwich. Indeed, heterovoiced tokens (.761) exhibit a positive correlation compared to the homovoiced ones which disfavour at .239.

Preceding environment. Similar to Ipswich, the effect of the preceding phonetic segment is stronger than the morphological class. The greatest effect is contributed by nasals (.714) followed by sibilant fricatives (.621), whereas /l/ (.422) along with non-sibilant fricatives (.388) and stops (.346) show a negative correlation. Similar to the East Anglian pattern, the findings from Norwich only exhibit a marginal change at the end of the hierarchy. In terms of the OCP, not only is the high position of /l/ surprising, but also the higher place of non-sibilant fricatives compared to stops.

(13) *East Anglian pattern:*
nasals > sibilant fricatives > /l/ > stops > non-sibilant fricatives

(14) *Norwich:*
nasals > sibilant fricatives > /l/ > non-sibilant fricatives > stops

Morphological class. Not surprisingly, morphological class is marked as a significant predictor following the ranking *n't* > M > S > R. Table 4.5.3 shows that when the negative contraction category is included in the model it is the only favouring predictor (.794); however, when *n't* tokens are excluded from the analysis monomorphemes favour deletion whilst semi-weaks and regular verbs disfavour deletion.

Sex. So far, none of the social variables presented any statistical significance except for sex in Norwich. Results from this location show that men delete significantly more than females, despite the low rate difference between the two factor groups. In the light of what has been presented and discussed so far, overall (t,d) seems to behave uniformly

across the three East Anglian locations. The next section, indeed, will demonstrate this graphically.

4.5.4 Interaction between locality and other predictors

This section sets out to discuss significant and non-significant interactions between locality and three major constraints: preceding phonological environment, following phonological environment and morphological class. Overall, the three predictors exhibit minor divergences between them, which are mainly due to slight ranking differences. Figure 4.5.1 illustrating a significant interaction, shows the trend of (t,d) in the preceding phonetic segment.

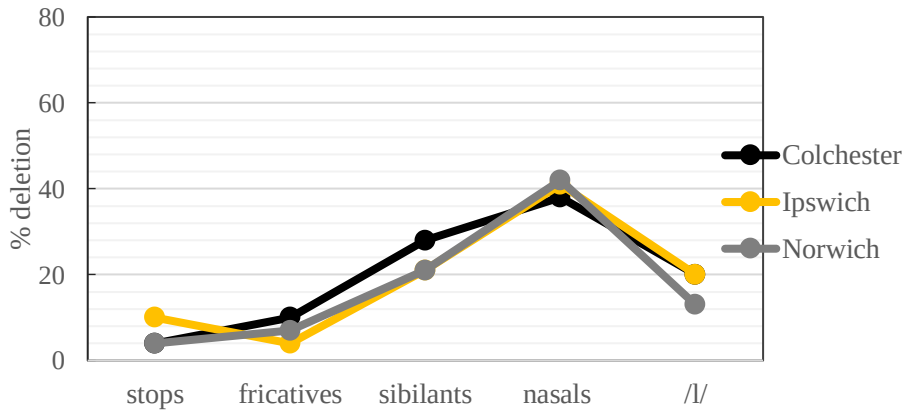


Figure 4.5.1 Interaction between preceding environment and locality, p <.001.

Figure 4.5.2, figure 4.5.3 and 4.5.4 illustrate probabilities of deletion in the following environment across the three localities and highlights some dissimilarities with the East Anglian hierarchy (overall results)[33]. Non-sibilant fricatives and sibilant fricatives strongly diverge in the overall East Anglian pattern, with the latter favouring the /t,d/ reduction and the former heavily disfavouring deletion. As discussed in section 4.4.1, this result is due to a following consonantal /h/ which plays a considerable role in

[33] The interaction between locality and following environment is not statistically significant (p > .05).

disfavouring deletion among non-sibilants. The consistency of this finding in the three urban areas proposes that (t,d) is highly retained before following initial /h/ - whether /h/ is realised or dropped. Therefore, this result suggests that the null hypothesis may prove false. Following pause, which typically varies across speech communities (Labov 1989; Patrick 1999), consistently disfavours deletion in Colchester, Ipswich and Norwich.

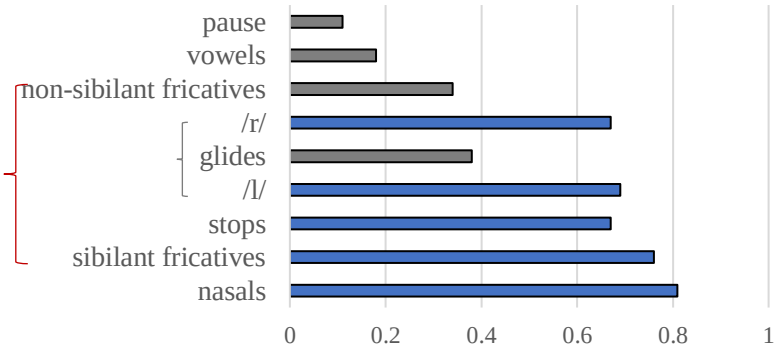


Figure 4.5.2 Probabilities for the following environment in Colchester.

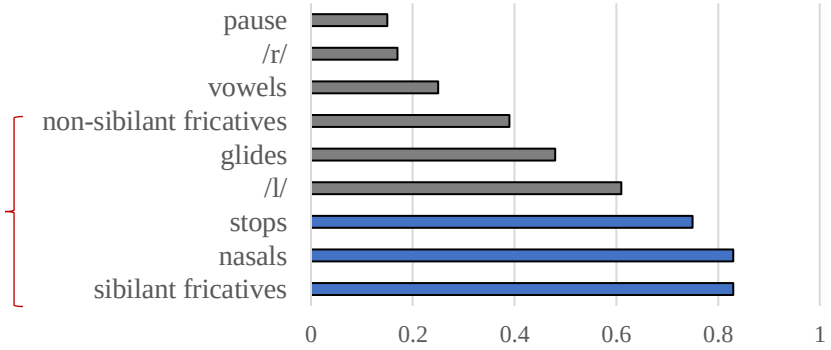


Figure 4.5.3 Probabilities for the following environment in Ipswich.

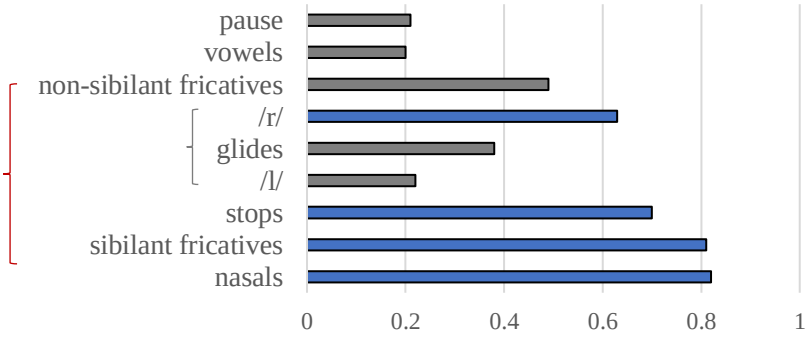


Figure 4.5.4 Probabilities for the following environment in Norwich.

Figure 4.5.5 illustrates the consistency of the morphological effect across the three urban areas, proposing the emergence of the expected morphological effect for (t,d) in East Anglia. Even in this case, the interaction between locality and morphological class is not statistically significant ($p > .05$).

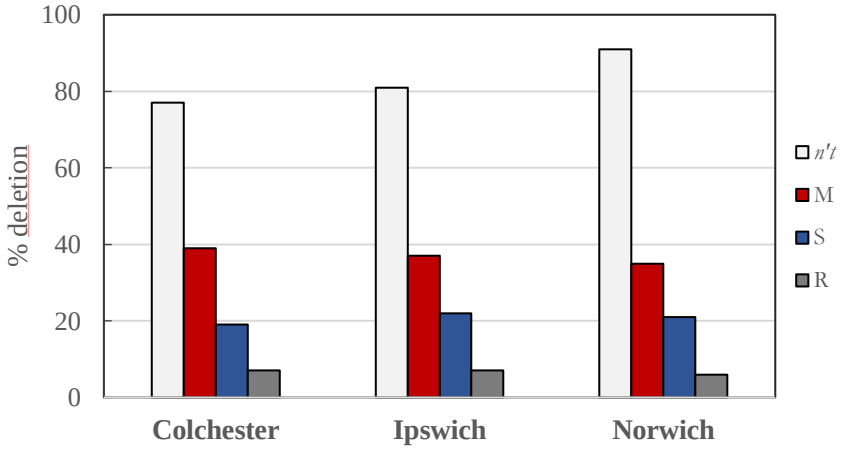


Figure 4.5.5 Morphological class across the three East Anglian localities.

4.6 Summary

This apparent-time survey on (t,d) deletion in East Anglian English has contributed to the field expanding on the (t,d) literature: a) new phonological insights were revealed after breaking down the consonant category for the following phonological environment, revealing that following sibilants and non-sibilant fricatives behave differently. Moreover, this Chapter reports local dialectal variation after laterals, yet not before /h/. b) It has shed light on the unsolved problem of morphological class in British English suggesting the emergence of the expected morphological effect for (t,d) in East Anglia. Finally, (t,d) deletion does not seem to vary due to morphological absence in semi-weak verbs. (t,d) is not governed by a sonority hierarchy and does not report visible OCP effects. (t,d) absence is not the only phonological phenomenon that can apply word-finally in British English; another typical feature of East Anglian

English which is common in most British dialects is (t) glottaling, the subject of the next chapter.

Chapter 5 - (t) GLOTTALING: LITERATURE REVIEW

This chapter extends the discussion on coronal /t/. In Chapters 3 and 4 we have discussed the reduction of /t,d/ in final consonant clusters but, deletion is not the only type of variation that /t/ can undergo in British English dialects. In this Chapter, I begin with a phonetic description of the coronal /t/ and its allophone [ʔ], with some terminological remarks which distinguish *(t) glottaling* from *glottal reinforcement*. These remarks also include additional phonetic components identified as a need to amplify the envelope of variation for (t) (Straw & Patrick, 2007). Before exploring the place of the glottal variant in phonological theory and in variationist sociolinguistic theory, I will critically review the diachronic development of the glottal stop in British English to challenge traditional assumptions which consider London a source of innovation for (t) glottaling as well as other southern phonological changes. Since the literature on (t) glottalisation and (t) glottaling is quite extensive, it will be reviewed selectively here, with the goal to outline previous studies which are relevant to the present research, as a point of comparison. Finally, a critical evaluation follows which will lead us to formulate specific research questions.

5.1 Articulatory description of the plosive /t/ and its variant [ʔ]

As a starting point, I will describe the manner of articulation of plosives which involves three stages: (1) closure in the vocal tract, (2) compression of lung air behind the obstruction and (3) airstream release (Hughes et al., 2012). A feature matrix for /t/ is [-continuant] [-sonorant] [+coronal] [-voiced] (Roca and Johnson, 1999), and it is articulated by the contact between either the tip or the blade of the tongue and the alveolar ridge. Its released voiceless segments can be of various kinds: when the

release of the underlying plosive is accompanied by a strong burst of air, the phoneme /t/ is called aspirated and it is articulated as [tʰ]. The latter may be often used before stressed vowels, whilst unaspirated [t] can be found elsewhere. In final pre-pausal environment, instead, the distribution of aspirated [tʰ] and unaspirated [t] is in non-contrastive distribution and varies freely (Wells, 1982).

Cruttenden (1994) observed that the alveolar stop /t/ contact is conditioned by the place of articulation of a following consonant. Hence, when the following segment is represented by the approximant /ɹ/, as in *try*, there will be a post alveolar contact [t̠], whilst when followed by /θ, ð/ as in *eighth*, the contact will be dental [t̪][1]. Moreover, syllable-final /t/ can undergo assimilation processes, generally regressive (i.e. *that man* [ðæp mæn]) or coalescent (/t/ + /j/ in *What you want* [wɒʧʊ wɒnt), implying variation in the place of articulation. However, the phonemic assimilation of place is sporadically finalised; spectrograms, indeed, reveal that some traces on the alveolar ridge complement the articulation.

In weakly accented contexts, /t/ is liable to affrication as in *time* [*tˢaɪm*]. This happens when the energy of release reaches affrication which is described as a short "period of audible friction" (Laver, 1994: 363). In many English varieties, /t/ may be realised as a flap [ɾ], articulated with the tip or the blade of the tongue at the alveolar ridge (Ladefoged, 2005). In addition to this kind of variation involving plosives, syllable-final /p, t, k/ can be replaced by the glottal stop.

The articulatory uniqueness of the glottal stop, in the English language, lies in the fact that it is the only non-oral obstruent-allophone (Pointer, 1996). Its primary articulation springs from the airstream obstruction and the total closure of vocal folds which suddenly release. Since there is no air passing during the glottal closure, [ʔ] is

[1] Both dental and alveolar variants of /t/ are also referred to as *apical* or *laminal*.

physiologically a voiceless sound (Gimson 1980; Roca & Johnson 1999). This explains why the glottal stop is mostly used as an allophone for voiceless obstruents /p, t, k/, as it shares significant and intelligible features with the phoneme it replaces[2]. In this case, [ʔ] shares two features: *stop* and *voiceless*, and differs in the place of articulation (Pointer, 1996).[3]

It has to be underlined that the articulatory description of the glottal stop given above is referred to *glottalled* plosives, and diverges from the articulation of *glottalised* variants, which may also involve either a 'creaky voice' or 'harsh voice'.

At this point, some terminological remarks need to be clarified as they appear sometimes confusing in the literature. *Glottaling* is adoped to indicate the realisation of a consonant as a glottal stop, usually in syllable-final or morpheme-final context when /p, t, k/ are followed by a consonant, such as *Scotland* (Hughes, et al, 2012)[4]. Hence, these variants are often called *glottalled* plosives, and the total replacement of /t/ by the glottal stop is usually referred to as *T-glottaling* (Wells, 1982).

As mentioned above, articulatory features for the glottal stop diverge from the articulation of *glottalised* variants. *Glottal reinforcement* (i.e. pre-glottalisation, post-glottalisation), in fact, is defined as: "a process whereby the primary supralaryngeal is accompanied by a secondary stricture of the glottal level" but this articulation fails to create a glottal constriction since it does not reach the utmost stricture of the full glottal

[2] From a taxonomic-phonetic standpoint, the glottal stop violates the *biuniqueness* requirement by which "one speech sound must be uniquely assigned to a given phoneme…in a unique way"; see Wells (1982: 54) and Lass (1984) for further details.

[3] Other features such as lip rounding and tension are not mentioned here as they are not relevant to the discussion.

[4] The use of the glottal stop as an allophone of /p/ and /k/, however, is more restricted and depends on the place of articulation of the following consonant: if both following consonant and the segment that is being replaced share the same place of articulation /p/ and /k/ will be more likely to be glottalled, as in *back garden* [baʔ ˈgɑː(r)d(ə)n].
Since in southern England the accent is non-rhotic, there would be hiatus if non-prevocalic /r/ would encounter a following vowel, therefore hiatus is resolved by *linking /r/*, which can also be replaced by the glottal stop. The latter, in addition, can also stand in place of *intrusive /r/*. A more detailed description is provided by Pointer (1996).

stop (Laver, 1994: 330). In many British accents glottal reinforcement is linked to the reinforcement of voiceless and affricate /p, t, k, ʧ/ in syllable final contexts. In such cases, the glottal stop follows the consonant [tʔ] (Trudgill, 1974) and takes the name of *T-glottalisation* when /t/ is the plosive reinforced. However, Straw and Patrick (2007) observed that the term glottalisation is sometimes used vaguely in the literature to indicate both glottal substitution and glottal reinforcement; Docherty and Foulkes (1999: 57) adopted the label 'glottal(ised)' claiming that it covers "two distinct [acoustic] factors".

In the case of a non-complete closure of the glottis, a distinct phenomenon usually called *creak* can be produced (Laver, 1994). Cruttenden (2014) describes creak as a creaky voice which involves energy to the vocal tract as well as a slow vibration of the vocal folds. He also distinguishes creaky voice from harsh voice with the latter referring to the vibration of false vocal folds[5].

The ejective stop is another variant of glottal reinforcement, articulated with an egressive stream of air. In other words, when the oral closure is realised, a total glottal closure is held. Ejectives resemble glottalised variants due to the glottal constriction involved during the articulation, yet the relative release timing is different. In the case of ejective stops, indeed, the oral release is the first (Laver, 1994). As claimed in the literature, this articulation can also occur with voiceless and affricate /p, k, ʧ/ indicating that they are more similar to glottalised variants than t-glottaling, however this question will not be addressed in this thesis as it is beyond the purpose of this study. To amplify and redefine the envelope of variation for (t), Straw & Patrick (2007: 395), in the Ipswich study, noted the following variants [tʰ] [t̚] [t'] [d] [ɾ] [ø] [ʔt] [tʔ].

[5] Creaky voice refers to the slow rate of vibration of the vocal folds (Laver, 1980).

So far, we have made some terminological remarks and explored the articulatory features of the phonetic variants, summarised in the tables below:

Phonetic variants of /t/		**Glottal variants of /t/**	
Unaspirated	[t]	T-glottaling	[ʔ]
Aspirated	[tʰ]	Creaky voice	creak
Affricated	[tˢ]	Glottal reinforcement	[ʔt] [tʔ]
Tapped	[ɾ]	Ejective	[t’]

Table 5.1.1 Phonetic variants and glottal variants of /t/.

This helps explain the place of t-glottaling within two branches of linguistic theory: Phonology and Sociolinguistics.

5.2 T-Glottalisation in Phonological Theory

This section attempts to provide a brief overview of how t-glottalisation has been treated from a theoretical viewpoint and what is meant by lenition/weakness in phonological theory, however an exhaustive phonological discussion on what counts as weak including a segment’s contexts or its intrinsic properties is not under scrutiny here[6].

From a phonological standpoint, (t) glottaling can be classified under the label of lenition processes. Hyman (1975: 165) explains lenition in the following terms: “a segment X is said to be weaker than a segment Y if Y goes through an X stage on its way to zero.” This process, also known as *debuccalisation*, refers to a consonant losing its place of articulation in the penultimate stage of weakening.

[6] For a more detailed account on the current perspectives on lenition see Honeybone (2008).

Zuraw (2009) corroborates Hyman's (1975) definition of lenition arguing that weak sounds are those that are vulnerable to deletion.

Harris and Kyne (1990), cited in Docherty et al. (1997: 286), claim that lenition is divided into two stages: *breaking* and *element-loss*: "breaking involves rearranging the occlusion and coronal elements into a contour structure which is parallel to that normally assumed for prenasalised stops, light dipthongs or affricates."

According to the generative phonological theory, lenition is regarded as the spreading of autosegmental features to neighbouring phonetic segments (Mascaró, 1983).

Carr's (1999) description of (t) glottaling as a weakening process is explained as a saving in articulatory time and effort: since the glottal stop lacks oral articulation, the tongue is free to assume its position for the following phonetic segment. However, in Carr's (1999) explanation, it is not clarified whether glottal reinforcement is deemed as a weakening or strengthening process. The latter occurs when consonants gain a different feature or their articulation is affected by a neighbouring sound (Pennington, 1996).

Harris (1994: 120) describes t-glottaling as a type of lenition which is a transitional stage between apical stop and elision

Plosive > ʔ (Glottaling) > Ø (Deletion)

explaining that /t/ can be glottalled on the basis of independent parameters of the language under investigation, taking also into account universal principles of phonological structure. Along this line, Kirchner (2004) proposed a constraint ranking LAZY>>PRES(place), where the place of articulation is preserved and the LAZY restriction aims at minimising the articulatory effort. Moreover, Kirchner (2004) suggests the following hierarchy as the most likely for /t/ to debuccalise:

Pre-consonantal syllable > preceding a vocalic nasal > word final preceding a vowel > preceding a vocalic /l/[7] > foot internal.

Many researchers have proposed scales of strength suggesting that segments' degree of weakness depends on their articulatory or acoustic features (Zuraw, 2009). Lass & Anderson (1975) believe that one criterion for the classification of consonantal strength is the resistance to airflow through the vocal tract, that is, the less resistance, the weaker the segment.

Carr (1991) examined "weakening" and glottalisation in Tyneside English accounting in particular for environments which trigger weakening more than glottalisation. By weakening Carr refers to the process by which /t/ is realised as [ɾ] or [ɹ][8]. As Docherty et al. (1997) highlight, Carr's prediction is that English feet are trochaic, hence glottalisation is not likely to occur in words such as *attack*, *at Easter*, etc. He claims that, unlike weakening, glottalisation can be found in nouns, adjectives, prepositions as well as monosyllabic words followed by an unstressed syllable. However, due to variability within the postulated claim, he proposes that "weakening applies to feet formed under cliticization post-lexically" (p. 283) which occur before glottalisation is applied, and tokens such as *fitter* and *fit her* (glottalised and weakened respectively), are apparently regarded to be in complementary distribution.

The *Sonority Sequencing Principle* (Goldsmith 1990, Laver 1994) has been also adopted to explain the behaviour of word-final /t/ glottaling in RP (Barrera, 2015). Barrera's (2015) results revealed that the more sonorous the following segment, the more it promotes the glottal stop. However, word-medial /t/ glottaling was found not to follow completely the sonority scale as vowels were ranked at the bottom of the hierarchy in

[7] Kirchner's (2004) hierarchy does not contain the process of vocalisation, although this phenomenon needs to be included in the lenition scale.
[8] This phenomenon is also known as the T-to-R rule (Wells, 1982).

intervocalic context. She claims that the low position of vowels in this phonological context could be due to the fact that the glottal stop has long been stigmatised intervocalically and it is mainly related to working-class accents.

A further theoretical prediction related to t-glottalisation has been made by Halle and Kaye (1990) who, in line with the Complexity Condition, point out that the replacement of /t/ with [ʔ] is blocked when /t/ is preceded by an obstruent, particularly if the latter has undergone vocalisation. By contrast, Docherty et al. (1997: 306), from a variationist perspective, observe that "present phonological accounts do not always accurately predict patterns of surface variation." Docherty et al.'s (1997) findings, indeed, exhibit the use of the glottal stop and [ɹ] in monosyllabic verbs across word boundaries, even though glottalisation was predicted not to occur in such a context[9]. Moreover, they point out that forms attested during the fieldwork are "frequently forms that are not predicted by theorists" (p. 288) and disconfirm Carr's claim that glottalisation and 'weakening' are in complementary distribution, providing evidence from data systematically collected.

It is clear that a *union* between phonology and sociolinguistics is yet unachieved and that the divergent stances taken by these two disciplines on (t) glottalisation are considered as an issue in terms of "descriptive adequacy" (p. 288). Hence, as Docherty et al. (1997: 275) note,

> "On the one hand, socially situated language samples which have been systematically collected and analysed constitute a legitimate –indeed often vital – source of evidence to be utilised by linguists for assessing and refining theoretical models. On the other hand, variationists cannot operate in isolation from theoretical concerns, and can benefit from an evaluation of the competing theoretical frameworks available to them."

[9] Results from this analysis are based on Hartley's (1992) recordings.

Variationist approaches usually diverge from theory-led approaches since initial formulated theoretical assumptions are not conventional, and theoretical hypotheses often emerge during systematic analysis of a considerable corpus of data. Eckert (1991), for instance, collected real data associated with specific social categories before developing a chain-shift model.

Having provided an overview of how (t) glottalsation is treated in phonological theory and having briefly explored some dissimilarities between theoretical phonology and sociolinguistics in respect to the glottal variant, it is now necessary to provide a deeper insight into sociolinguistic accounts for (t) glottalisation.

5.3 T-Glottalisation in Variationist Sociolinguistic Theory

As mentioned above, sociolinguistic theory, unlike structuralist-generative models, is constructed on the bases of external evidence (Docherty et al., 1997) and explores the correlation between specific linguistic features and social factors. The social factors found to significantly constrain /t/ glottaling are listed as follows: *style* (e.g. Holmes, 1997), *age* (e.g. William and Kerswill, 1999), *gender* (e.g. Milroy et al. 1994) and *social class* (e.g. Trudgill , 1974); this explains why glottal variation in /t/ is a *variable rule* as it is not independent of social considerations (Wells, 1982). In sociolinguistic theory, intervocalic /t/ glottaling, as in *letter*, is traditionally regarded as a *marker* of working-class British speech (Trudgill, 1974, 1988; Macauley 1977) as it has diffused in all social classes and styles, yet still exhibits social and stylistic variation. This definition springs from a three-fold distinction: (a) *indicators*, (b) *markers* and (c) *sociolinguistic stereotype,* made on the basis of the interaction between sociolinguistic variables and the social stratification in a given speech community (Trudgill, 1986). *Indicators* refer to stratified linguistic features occurring below the level of social

awareness, with no significant difference in the degree of formality, and to which little or no social import is attached (Labov, 1972). *Markers*, instead, are variables associated with a low level of awareness, but show consistent style effects. Linguistic variables which become popular features of a particular group and which can be overtly commented on are usually referred to as s*ociolinguistic stereotypes* (Trudgill, 1986).

Formulaically, the status of /t/ can be illustrated as (after Trudgill, 1974: 174):

$$/t/ \rightarrow x \ < [t] \ \sim [tʔ] \sim [ʔ] >$$

$$x = f \text{ (style, class, age)}$$

In other words, /t‘/, /t^{h}/ and /t/ are deemed “extrinsic allophones which belong at the systematic phonetic level”, whilst [tʔ] and [ʔ] “are not extrinsic allophones, but variant realisations, depending on sociological variables, of the extrinsic allophones /t‘/and /t/ at the phonetic realisation level”, which are usually found in casual speech of young urban working-class speakers (Trudgill, 1974: 157). In the literature, /t/ has often been examined separately in word-final or word-medial position with particular attention to the phonotactic environment. So far, the bulk of research has predominantly focused on the environment following /t/, and three contexts are usually compared: preconsonantal /t/ (PreC), prevocalic /t/ (PreV) and prepausal /t/ (PreP).

In many British dialects results tend to be constant, with PreC deemed the most influential linguistic factor that favours glottal variants. Straw and Patrick (2007), indeed, refer to the following traditional ranking PreC > PreV > PreP as the *diffusion pattern*[10]. Hughes et al. (2012) summarise the common findings including syllabic nasal, syllabic lateral, and intervocalic /t/ in the hierarchy to follow[11]:

[10] This term refers to both its geographical diffusion as well as its spread through the different linguistic contexts.

[11] Note that a following pause is not included in this hierarchy.

most frequent	word-final pre-consonantal	*that man*
↓	before a syllabic nasal	*button*
↓	word-final pre-vocalic	*that apple*
↓	before syllabic /l/	*bottle*
least frequent	word-internal pre-vocalic	*better*

Table 5.3.1 Most frequent and least frequent environments for t-glottaling to occur.

Recent studies show that [ʔ] seems to have spread up to the upper class (including young members of the royal family) and it is adopted by many RP speakers word-initially before vowels (*ant*), pre-consonantally, pre-nasally (Hughes et al., 2012) as well as in pre-vocalic and pre-pausal contexts (Barrera, 2015). These findings suggest a language change in progress given the results previously reported by Fabricius (2000), and later confirmed by Altendorf (2003), displaying no pre-pausal and pre-vocalic t-glottaling in the more formal styles among upper middle-class speakers in London; whilst, t-glottaling in intervocalic position is still firmly stigmatised in RP. Barrera (2015: 13) also suggests that, in RP, "lexical frequency seems to be playing a role in the different progressing stages of the glottal stop word-internally and across word boundaries."

It is also important to outline that Fabricius' (2000: 134) RP speakers exhibit a regional variation:

> "Pre-consonantal glottaling can reasonably be regarded as the 'first wave' of glottaling. The 'second wave' seems to be pre-pausal category, which shows a significant difference between the Southeastern category and the 'rest of England' category. As we have seen, London and the Home Counties pattern together on this feature, while the rest of England lags behind. The 'newest' wave of glottaling is evident in the pre-vocalic category, where the London-raised public school speakers use pre-vocalic

> glottaling at a significantly higher rate than speakers from other parts of England in less formal styles of speech."

According to the *Survey of English Dialects* t-glottaling has been traditionally found in Norfolk, London and the Home Counties (Orton and Tilling, 1969), whilst glottalised variants have been recognised in East Anglia (Norfolk, Suffolk and Essex) and East Cambridgeshire. At this point, before exploring in more detail how the glottal variants behave in southern British dialects and northern British dialects, we should turn our attention to its diachronic development in order to understand where it has originated and how it has geographically spread.

5.4 Diachronic development of [ʔ]

Geolinguistics reveals that the distribution of glottal stops is extremely marked in the South of England and that in both intervocalic and word-final environment [ʔ] is still geographically spreading (Straw & Patrick 2007). Yet, where has it started spreading first? Despite lack of consensus amongst linguists as to where the glottal feature started and even though no research has shed light on its origin so far, three locations can be identified as plausible places where it might have developed first: East Anglia, London, Glasgow.

Trudgill (1974) claims that East Anglia - Norwich in particular - seems to be "the centre where glottaling has diffused geographically" as its geographical position might have facilitated the glottal feature to spread. After consulting the Survey of English Dialects (SED), Trudgill (1974) demonstrated that in the 1950s intervocalic t-glottaling was only present in one rural southern area of England: northern East Anglia. If this plausible explanation is accurate, it implies that the glottal stop spread from East Anglia to London. The *Linguistic Atlas of England* (LAE), indeed, shows evidence of

t-glottaling only in East Anglia and a small area around London, as in figure 5.4.1 (Orton et al., 1978).

London, however, is usually cited as the principal geographical source for the spread of t-glottaling and it is generally associated with Cockney English - the working class accent of East End Londoners. Some linguists (Matthews 1972, Wells 1994, Williams and Kerswill 1999, Altendorf 2004) believe that t-glottaling is actually not the only phonological innovation that spread in southern England and the rest of the UK from London, but also other variables such as TH-fronting and L-vocalisation[12]. These new variables, according to Altendorf (2004), share some characteristics since they all stem from non-standard accents, they are all associated with London English and, in the south-east, it appears that they have been diffusing regionally and socially, spreading up the social scale and into formal styles. Przedlacka (2001: 48) evinces that London is a potential and powerful source for linguistic innovations due to its political, economical and cultural influence "from which innovations normally radiate outwards".

[12] Johnson and Britain (2007) suggest that the origin of /l/ vocalisation is not rooted in the south-east of England (or at least in East Anglia) as the phoneme /l/ was reported to be clear in all environments until the 20th century. Ihalainen (1994) found evidence of /l/-vocalisation in Yorkshire between the 17th and 19th century, Orton (1933) reports its presence in South Durham and Wright (1905) observed it in the North of England. For further details on the diachronic development of /l/ vocalisation see Johnson and Britain (2007).

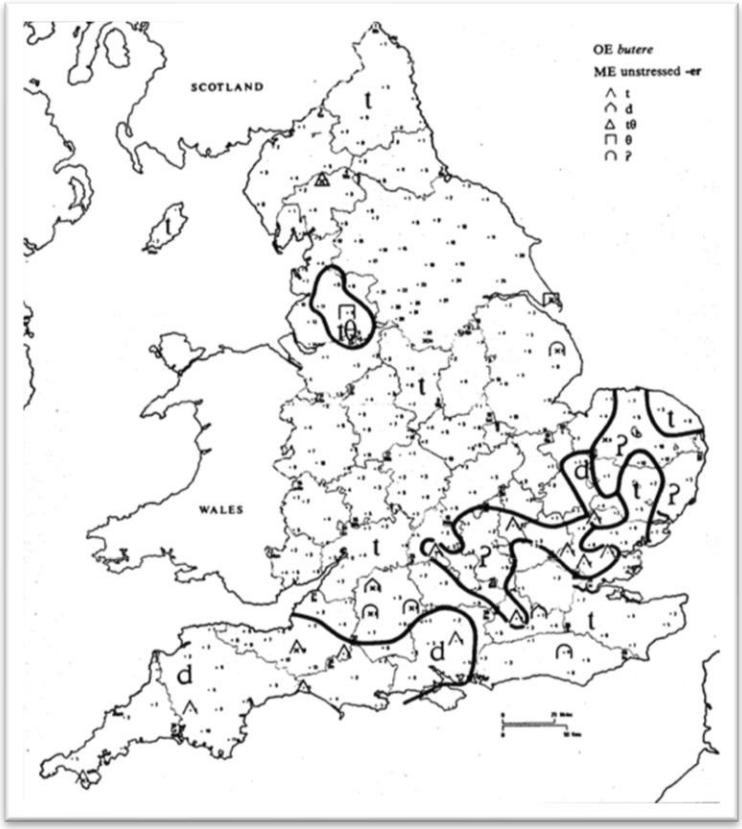


Figure 5.4.1 Evidence of glottaling in the Linguistic Atlas of England. Adapted from Orton et al. (1978).

Wells (1982) suggests that "either this is a new, twentieth-century, phenomenon, or no phonetician had previously noticed it". In the survey carried out by Ellis (1989), entitled *On Early English Pronunciation*, he provides evidence from several observers from among Walker (1072- 1807) and Smart (1836), who discussed Cockney, yet none of them seems to have noticed the presence of glottal stops in earlier centuries. Only Ellis (1889) reports the loss of final and medial /t/.

The second origin, suggested in the literature, is Scotland. Wright (1905: 287) found evidence of the glottal stop in "west-mid Scotland, Lothian and Edinburgh", and only before schwa [ə] plus liquid consonants /l/ or /r/ in the next syllable (e.g. *battle, better*). However, as reported in Wells (1982), in the first edition of *Pronunciation of English* by Jones (1909), it is argued that [ʔ] was frequently used to replace /t/ both in Scotland and London. Andrésen (1968) confirms the use of (t) glottalisation in Scotland

claiming that it gradually diffused in the West of Scotland (attested in 1860), in the East part of Scotland (attested in 1889), in the North of England after twenty years, and finally it reached the Midlands and London (1909)[13]. Upon consultation of previous reference on glottalisation, between 1900 and 1930, Collins and Mees (1996) write that a general acceptance of [ʔ] started after the Second World War, and it was introduced even in phonetic transcription such as O'Connor (1952) and in description of RP (O'Connor 1952, Christophersen 1952). Christophersen (1952) examines the morphological environments where glottalisation of /p, t, k, ʧ/ can occur, but, as Holmes (1995) observes, he only discusses glottal reinforcement. Pre-glottalisation, indeed, is thought to be associated with the north rather than the south of England (Wells, 1982).

Later, Macafee (1997) adds that the glottal stop has precisely emerged from Glasgow and rapidly spread to Scotland and throughout the UK. Stuart-Smith's (1999) review on Glasgow studies, shows that the glottal feature has been used, since the 19th century, in both word-medial and word-final contexts, whilst a following vowel was less likely to foster a glottal insertion. Yet, Romaine's (1975) findings, based on data collected in Edinburgh, propose a different ranking resulting in PreV > PreP, where a following vowel triggers glottalisation more than a following pause[14].

However, the lack of earlier descriptive evidence is not a reason to assume that the glottal stop is a recent sound or emerged in the 19th century. As a result, Abercrombie (1948) mentioned some studies going back to the 17th century where the glottal stop was found at the onset of initial vowels. Cruttenden (1994) argues that it is improbable that t-glottaling is older than 200 years in London. I believe that even if London is a

[13] The earliest of evidence of glottal reinforcement for /p/ and /k/ appears not to be mentioned before 1909 (Andrésen, 1968).
[14] PreC might have been excluded because it was probably categorical.

great potential source for linguistic innovations, there seems not to be strong evidence to claim that it is the first geographical place where the glottal stop has originated. Its more recent spread throughout the country, however, is likely due to influence from London. The *LAE*, as aforementioned, shows that the glottal variant was present in a *small* area of London (Orton et al., 1978), and Ward (1929), cited in O'Connor (1952), observed that this usage did not occur among London speakers. Moreover, recent studies propose that "the use of the (t) variable by Ipswich Anglo urban speakers does not suggest diffusion from London" (Straw & Patrick, 2007: 404), and Schleef (2013) reveals that t-glottaling is more developed in Scotland (particularly in Edinburgh) than London. Hence, it seems that the two plausible geographical sources - or "dual epicentres" as called by Kerswill and Williams (1997) - where the glottal variant might have originated are East Anglia and Scotland.

5.5 T-Glottalisation in Southern England

Considering its geographical diffusion, it is evident that glottal variation in /t/ is recurrent in both the north and south of England. Some studies, as discussed above, have shown that non-standard varieties seem to undergo more recurrent changes, mostly occurring in the south-east of England. T-glottaling and t-glottalisation, indeed, have been investigated in London and the Home Counties (e.g. Tollfree 1999; Schleef 2013), Reading (Williams & Kerswill, 1999), Milton Keynes (Williams & Kerswill, 1999), Norwich (Trudgill, 1974, 1988, 1999, 2003), Ipswich (Straw & Patrick, 2007), and Essex (Altendorf, 2003). Despite the extensive literature, this section places under scrutiny studies carried out in East Anglian counties (Norfolk, Suffolk and north Essex) from 1889 until 2007; secondly it focuses on London vernacular.

5.5.1 East Anglia (1889 - 2007)

Early studies carried out by Ellis (1889), Kökeritz (1932) and the SED (1962) have considered phonological and syntactical aspects of East Anglian English, yet their work lacks a variationist perspective[15]. Ellis (1889), as mentioned earlier, only commented on the loss of final and medial /t/, whilst Kökeritz (1932), who provided a descriptive phonological account of the Suffolk dialect of the 20th century, noted that despite the wider discussion on English dialects the Suffolk accent had not received full attention. Earlier work (Binzel, 1912), for instance, focused on the interpretation of spelling rather than real speech data. Hence, Kökeritz's (1932) work seems to be the first study to investigate the phonology of the Suffolk dialect, although the methodology adopted is not appropriate by modern standards

Claxton (1960: 5) in the second edition of *The Suffolk Dialect of the 20th Century*, states that, in Suffolk, "the consonant 't' is usually articulated and not 'swallowed' as in the Norfolk where 'water' is pronounced as 'wa-er', 'butter' as 'bu-er', 'city' as 'ci-y' ".

In 1962, evidence of the glottal stop in East Anglia, was provided by *The Survey of English Dialects* (SED). East Anglia, as mentioned earlier, was identified as the area where two types of glottal variation occur: glottalised and glottalled variants. The former was widely found in Norfolk, Essex and Suffolk (mentioned here in a decreasing order of diffusion assuming an origin in Norfolk), whilst the latter was predominately used in Norfolk and partly in Essex, as shown in figure 5.5.1.

Later, Orton et al. (1978) in *The Linguistic Atlas of English* (LAE) reported the use of [ʔ] in Norfolk as well as a small area around London.

So far, it seems that little research relevant to language variation and change had been conducted until Trudgill's (1968) study. His work on the co-variation of phonological

[15] See section 2.5 for further details related to early field methods.

features with sociological parameters in Norwich, follows soon after the earliest community-based research in sociolinguistics by Labov (1963). For his study, Trudgill (1974) adopted a quasi-random sample extracted from four ward voter registration lists, where an equal number of participants was randomly selected[16]. The sample consisted of 60 speakers[17], stratified according to sex, age and social class. To assign each speaker to a social group, he employed a six point-scale.

Results from the Norwich study show that glottal variants occur intervocalically and in syllable-final context (i.e. *better*, *bet*), yet they are blocked in stressed syllable initial position (i.e. *tea*) or in /n_/ and /l_/contexts (i.e. *went*, *felt*). A further restriction was suggested before and after schwa /ə/ or unstressed /ɪ/; however, Trudgill shows that in the case of stressed /ɪ/, as in *went into*, the use of glottal stop is permitted. Glottal variants were also found proportional to class, sex and social context since they decrease as formality increases, confirming that women tend to use more of the standard variant than men and that glottal variants were predominantly found in casual speech of young urban working-class speakers. Trudgill (1988) also highlights that the glottal stop is spreading into more formal styles and, unlike youngsters, old people tend to avoid the stigmatised feature in certain situations, and that it may be an endogenous change.

[16] The four wards were: Eaton, Lakenham, Helledson and Westwick.
[17] Ten informants were schoolchildren from two schools.

Figure 5.5.1 Distribution of glottal variants. Adapted from Trudgill (1974).

The Norwich study, however, does not comment on phonological environments that are significant in terms of diffusion. Further details on this point were subsequently provided by Straw and Patrick (2007) in the Ipswich study.

Despite the extensive discussion on East Anglian dialects provided in the late 20th century by Trudgill (1974, 1986), Fisher (2001) and Britain (2002), Ipswich appears to be sporadically mentioned and no study appears to have reported the ranking of phonological environments favouring glottal variation in /t/ in this community until 2007 when Straw & Patrick's study was carried out. The purpose of their preliminary research, which examines glottal variation of /t/ in word-final environment, is (a) to compare the dialect of four Anglo speakers in Ipswich to that of four Barbados-born speakers in the same community, considering whether Ipswich Anglo urban speakers indicate diffusion; (b) to explore whether the patterning among Barbadian speakers

mirrors dialect acquisition; (c) in response to Docherty and Foulkes' call (1999), they investigate whether the 'received wisdom' of glottal variants is methodologically secure.

Data were collected from participants who live in the same working class neighbourhood, and the participants were stratified according to sex and two age-groups (elder speakers 68-74 and middle-aged 40-55). A total number of 250 tokens[18] was analysed by means of acoustic analysis employing five parameters "to reduce the perceived glottal variation: (1) presence or absence of glottal occlusion; (2) duration of the gap in milliseconds; (3) presence or absence of laryngealisation; (4) location of laryngealisation and (5) presence or absence or voicing irregularity.

Results from auditory analysis were consistent with findings from previous British dialects[19] (resulting in the *diffusion pattern*, as previously discussed), but results from acoustic analysis turned out to change the picture: glottal replacement was found not to occur as much as predicted by auditory analysis and a different ranking triggering glottal variation in /t/ was exhibited. Hence, this peculiar pattern amongst Ipswich Anglos, called the *Ipswich pattern* (after Straw and Patrick, 2007: 393), suggests that the PreV context favours glottal variants the most: PreV > PreC > PreP. This study concludes that "the use of the (t) variable by Ipswich Anglo urban speakers does not suggest diffusion from the London area." (p. 404). However, as the authors note, some questions remain open: how similar Ipswich and Norwich are; whether the Ipswich pattern is retained and whether there are signs of diffusion from Norwich.

Not only was Ipswich only sporadically mentioned in the discussion of East Anglian dialects, but also Colchester, where little systematic research has been conducted so far. Together with London and Canterbury, Colchester was chosen by

[18] The average per speaker equals 31 tokens.
[19] Note the PreC, PreV and PreP environments were not previously employed in East Anglia.

Altendorf (2003) to investigate Estuary English[20]. She explored five vocalic variables and six consonantal variables (t-glottaling included) in 10 female informants, recruited in three types of schools: comprehensive school (two working class females), grammar school (six middle class females) and private school (two upper class females). The three cities were not equally stratified in terms of social class, indeed, in Colchester, only the middle class was explored. Moreover, if the six middle class females were proportionally distributed across the three cities, two informants only would be representative of Colchester.

Results for (t) glottaling exhibit the following ranking: PreC > PreV > PreP > pre-lateral /l/ > intervocalic position, where the glottal variant is favoured before consonants more than in intervocalic position. T-glottaling was also found in all social classes as well as in more formal styles, even though it displays both social and stylistic variation. Middle class speakers, for instance, would reduce the use of the glottal variant in PreV and PreP, whilst it was completely avoided intervocalically where the stigma seems to persist, even in more formal styles.

The upper class informants' speech diverges from the middle and working class especially in PreV and PreP contexts where the use of glottal stop is highly reduced and it is almost completely absent in the formal reading style. Intervocalically and in pre-syllabic /l/ environments, however, it is still stigmatised. However, an interesting result was found within members of the working class where (t) glottaling in pre-syllabic /l/ was used with the same frequency as word-medial pre-consonantal (e.g. *Gatwick*). Altendorf (2003) states that (t) glottaling is increasing in PreV and PreP environments among middle class speakers, in spontaneous speech, with a rate nearly five times higher than Hudson and Holloway's (1977) study, as we will see later in the

[20] Estuary English was defined as "a variety of modified regional speech, a mixture of non-regional and local south-eastern English pronunciation and intonation" (Rosewarne, 1984).

chapter. As opposed to the limited research in Colchester (Altendorf, 2003), Ipswich (Straw and Patrick, 2007) and Norwich (Trudgill 1974, 1988, 1999, 2003), (t) glottalisation has received full attention in London being stereotypically associated with Cockney, and due to the position of London in England (as political capital) which is usually deemed a "linguistic centre of gravity" (Wells, 1982: 301).

5.5.2 London vernacular (1938 - 2013)

As noted during the historical development of /t/, Ward, in 1929, commented on the use of glottal variants that, at that time, were not present in the speech of Londoners. Early evidence of [ʔ], in Cockney, was reported by Matthews (1938: 80) who claimed that: "the chief consonantal feature of the dialect is the prevalence of the glottal stop." Sivertsen (1960: 199) claims that, in Bethnal Green, "the alveolar stop, at least when it is strongly affricated in the environment [V_V], is looked upon as being too '*posh'* for a Cockney to use: ['ˈbetsə](= *better)* is '*posh'*, ['betə] is normal, and ['beʔə] is '*rough.'* She found [ʔ] intervocalically in tokens such as *getting* with a syllabic /n/ as well as word-finally before vowels (e.g. *right in*). However, intervocalically across boundaries, EE were more likely to adopt the alveolar approximant (T-to-R rule), although this feature was not typically described for London English.[21] In addition, the glottal variant was adopted more often by men than women, as confirmed later by other studies.

Beaken (1971), cited in Wells (1982), investigated the speech of schoolchildren in the East End of London, reporting the use of glottalised /p t k/ in word-final position.

[21] Hickey (2005) reports that the T-to-R rule is common in Northern England and in vernacular Dublin English.

In more detail, the proportion of glottal variants in this context was 73:4 in males' speech and 46:14 in girls' speech.

Hudson & Holloway (1977) reported that t-glottaling was more frequent in PreC than PreV contexts, with a larger percentage of glottaling in PreV for middle-class males, working-class females and working class males, whilst middle-class females exhibit 20 percent of prevocalic glottaling.

Tollfree (1999), in her study conducted in different regions of South East London[22], observed that both age groups (15-30 and 54-89) of South East London Regional Standard speakers (SELRS) produced glottalised variants in PreC context across a word boundary (e.g. *ticket box*), as well as in word-internal environment (e.g. *nightmare*). In preceding syllabic /n/ (e.g. *button*) old SELRS did use the glottal feature, yet it was stigmatised in preceding syllabic /m/, preceding lateral /l/ (e.g. *bottle*) and intervocalic contexts. In PreV cross-word boundary as well as PreP position, (t) glottalisation was sporadically used. In South East London English speakers (SELE) glottal variants were near-categorical in PreC and PreP and, unlike SELRS, t-glottalisation was frequently adopted in PreV context and intervocalically. She also reported that "t-glottalisation […] operates freely between the stem and the compounds" (p. 171) (e.g. *a put-on*), yet it is blocked when the segment which precedes /t/ is a non-resonant consonant (e.g. *project, sister, chapter*) and in word-internal foot-initial onset position (e.g. *particular*). By contrast, in word-internal non-foot initial onset context (e.g. *printer*, *botany*, *Saturday*) it was often attested. Her results also reveal that t-glottalisation seems to be "highly sensitive to prominence patterns" (p. 172) and is more likely to operate in tokens such as *litter* and *butler*, where the

[22] The data were gathered in Peckham, Sydenham and Penge (working class), as well as Dulwich, Beckenham and Bromley (middle class), were a total number of 90 informants was interviewed. Her participants were divided into two groups: SELE (South East London English) and SELRS (South East London Regional Standard).

prominence is [1 2] and [1 3 2] respectively, but the process is blocked in items like *pretend* [2 1] and *contemptible* [2 1 3 4].

Schleef (2013) examined t-glottaling in London and Edinburgh among teenagers stratified by sex and age. His results show that the variable is phonologically controlled, but most importantly, it intersects with morphological categories and shows evidence of lexical diffusion. Word-final /t/, in both London and Edinburgh, exhibits the typical pattern PreC > PreP > PreV, with following nasal, liquid and fricative favouring (t) glottaling, whereas following plosive, glide, pause and vowel disfavoured it in both locations. As for the preceding environment, preceding nasals and liquids disfavoured glottal realisation of /t/, whilst preceding vowels[23] favour it. Glottal replacement was more frequent in informal style and occurred more often in word-final position than in word-medial context, yet no gender difference was identified. It seems that this finding is not very surprising as it suggests that when changes approach an endpoint, the gender difference tends to disappear (Labov, 2010). From a grammatical standpoint, function words, progressive verbs as well as past participle were found to favour t-glottaling; on the contrary, adjectives and nouns disfavoured it. He also found that the number of syllables plays a role in Edinburgh, as words of four and five syllables seem to trigger t-glottaling more than words of three syllables. Finally, the proportion of application value reveals that t-glottaling is more developed in Edinburgh than London, hence he claims that:

> "this makes speculations on the longer history of T-glottalling in Edinburgh, when compared with London, very plausible. Furthermore, considering the high degree of similarity of the factors constraining variation in /t/, a diffusion scenario seems more likely than independent development." (p. 212).

[23] It has to be noted that both preceding and following vowel, were not coded according to their place of articulation.

In contrast to the long history of t-glottaling in Edinburgh, this phenomenon is recently being acquired as a prestigious feature in some southern English varieties, such as Cardiff English.

5.6 T-Glottaling in Cardiff

Mees & Collins's (1999) study explored the spread of the glottal variant in Cardiff English. Word-final t-glottaling was analysed in PreC, PreV and PreP environments, along with social class[24] (working class, lower middle class and middle middle class), gender, time (1976, 1981 and 1990) and style (reading passage and casual style).
Results for t-glottaling in word-final context exhibit a prestigious spreading with young middle class females leading the change. By contrast, the glottaling rate in the same linguistic context was found to be very low among working class speakers. In this respect, Mees & Collins (1999: 202) claim that:

> "the upwardly mobile Cardiff females can be seen to acquire RP-style glottalisations together with a professional career, a suburban house and a well-qualified partner. Those who lack such aims are also likely to lack glottalised forms."

They also suggest that London's lifestyle along with public figures and celebrities, who are often heard using the glottal stop and considered trendy, have an influence on the way people speak. Hence, t-glottaling is perceived as a prestigious and trendy feature.

After reviewing, selectively, the literature on t-glottalisation in southern British dialects, starting from East Anglia – the focal point of this study – to London and Cardiff, let us now move north above the FOOT-STRUT split.

[24] The class stratification of speakers was based on father's occupation.

5.7 T-Glottaling in Northern England

The FOOT-STRUT split, according to the *Dialects of English* (Trudgill, 1999), is one of the foremost isoglosses (along with the BATH broadening) marking a dialect boundary between the north and the south of England[25]. Like southern dialects, glottal variants were reported for the West Midlands (Mathisen, 1999), Derby (Docherty & Foulkes, 1999), Hull (Williams & Kerswill, 1999), Newcastle (Milroy et al., 1994; Watt & Milroy, 1999), Sunderland (Burbano-Elizondo, 2015), Middlesborough (Llamas 2001, 2006), Manchester (Baranowski & Turton, 2015) and the Fenland (Britain, 2015).

The Fenland represents the major dialect transition zone where northern varieties meet southern ones (Britain, 2014). In this site, (t) glottaling is extensively adopted, even intervocalically. Moreover, evidence of glottal replacement was also found in word initial context, if /t/ occurs in an unstressed syllable, as in *tomorrow* and *today* (Britain, 2014).

In the North-East, /t/ is usually studied alongside /p/ and /k/ as they all can be articulated as stops, glottalled and glottalised variants. Glottalisation of word-medial /p/ and /k/, indeed, have been frequently reported in the literature as a distinctive feature of Newcastle and Tyneside English (e.g. Milroy et al. 1994; Docherty et al. 1997; Watt & Allan, 2003). It was also attested in Durham (Kerswill, 1987) and Sunderland (Burbano-Elizondo, 2008). However, in spite of being examined together with the other two voiceless plosives /p/ and /k/, this section will be concerned with glottal variation in /t/ only.

[25] The linguistic north delimited by these isoglosses comprises "from the Scottish border as far as a line from the Mersey to the Humber, including most of the Midlands. It includes, for example, the Birmingham-Wolverhampton conurbation, Leincester and Peterbourough" (Wells, 1982: 349).

In Newcastle, Milroy et al. (1994) examined five variants of (t) in the informal speech style of 32 informants, stratified by social class (16 working class, 16 middle class), gender and two age groups (16-24; 45-65). A total number of 2,838 tokens were analysed in word-final environment, and results show that young middle class females were leading the use of glottalled variants, whilst working class speakers as well as old speakers fall behind. Hence, glottalled features were associated with middle class members, whereas glottalised variants were more frequent among working class speakers. Overall, it seems that females are leading the diffusion of t-glottaling in Newcastle, and that it is a supralocal change.

Similarly, Burbano-Elizondo (2015) found that, in Sunderland, middle-class females are leading the change for (t) glottaling, whilst glottal reinforcement [ʔt] exhibits a higher percentage in males (38%) than females (10%). She reported that glottalled features are used 59.8% of the time, with a significantly increasing rate over time (i.e. among the young) – similarly to Middlesbrough (Llamas, 2001). Comparing results from Sunderland (Burbano-Elizondo, 2015) with findings from Newcastle (Docherty, 2007) and Middlesbrough (Llamas, 2001), it was observed that the use of [ʔt] decreases as the distance from the North Eastern 'capital' city increases, reporting an increase of [ʔ]. In terms of geographical diffusion patterns, the increase of [ʔ] for /t/ in Sunderland is less advanced than in Middlesbrough, yet more than in Newcastle, contrary to any expectations which suggested that [ʔ] would spread to larger cities first and subsequently to smaller localities. Docherty & Foulkes (2005) investigated /t/ glottalisation in Tyneside, where the use of the glottal stop is well-established in word-final context pre-consonantally, yet it is sporadically adopted intervocalically or pre-pausally.

Jeffries (2011) examined the acceptability of (t) glottaling in the head of a primary and secondary stressed foot, as in *thirteen* and *retain*. The dataset consists of acceptability scores from West Yorkshire informants who rated (t) glottaling based on audio clips. Her results show that the transition /t/ → [ʔ] occurs when /t/ is not in the head of a foot, either before an unstressed vowel (e.g. *butter*) or word-finally (e.g. *what*). Even though glottaling is prohibited by foot-based accounts and syllable-based accounts, she suggests that glottal variants can be found before long, high vowel /i:/ or /u:/.

Broadbent (2008) shows that as (t) glottaling was advancing in Yorkshire *t*-to-*r*, which was the dominant lenition process, became weaker.

Baranowski & Turton (2015) explored three consonantal variables, two of which are undergoing a change (T-glottaling as well as TH-fronting) and a stable variable (H-dropping) in Manchester[26]. T-glottaling was explored particularly in word-final postvocalic /t/ (e.g. *cat*) and intervocalically (e.g. *butter*). Auditory analysis of 86 speakers, stratified by sex, age and socio-economic class[27] (working class and middle class) was conducted, and a total number of 3,727 and 2,043 tokens, for word-final postvocalic /t/ and intervocalic /t/ respectively, was analysed.

Results for word-final /t/ find age and the following segment to be the only significant predictors, with glottal replacement less likely to occur among older speakers[28]. Since gender and social class were not marked as significant predictors, this pattern suggests that word-final t-glottaling should be considered as an advanced change nearing

[26] It has to be noted that, unlike the many North-East cities, Manchester displays few pre-glottalised variants.

[27] Age was used as a continuous variable, whilst socio-economic class was based on occupation since, according to Baranowski and Turton (2015), other measures for social status were employed, such as education, yet occupation has usually produced the best model.

[28] This finding seems to be in contrast with Davies and Braber's (2011) study, which reports a frequent use in the older generation in the East Midlands.

completion. Even in Manchester, similarly to other studies reviewed above, young middle class females displayed the highest rate of glottal variants, yet, according to Baranowski & Turton (2015), this may be due to age-grading. In intervocalic context, middle-aged working class males seem to have a remarkable tendency towards the glottal articulation, with middle-aged middle class females falling behind. This finding suggest that the change in the intervocalic phonological environment began in the WC social group. Both glottalisation and glottaling were attested in the so-called *-ee/oo* words (e.g. *canteen, tattoo*), although glottalled features in this context were rare among Mancunian speakers. Finally, as expected, T-glottaling is sensitive to style-shifting even in Manchester.

5.8 T-Glottaling in Scotland

Moving further north, we find a second plausible epicentre of glottal(ised) variants that has received sociolinguistic commentary: Glasgow. Stuart-Smith et al. (2007), for instance, explored t-glottaling, among eight other consonantal variables, in 32 speakers, stratified by sex, age (adolescents and adults) and social class (working class and middle class). The data were collected by means of sociolinguistic interview as well as a word list with a number of tokens equal to 3,597.

Results, if compared to Macaulay's (1977) study, indicate a real-time increase of glottals in Glasgow, with a higher rate for the working class (92.47%) than for the middle class (56.56%) in informal speech. In the more formal style there is a clear difference between the two classes: the former displayed a 76.32 per cent of t-glottaling, whereas in the latter the glottal variant seems to be inhibited given the very low rate of production (4.65%). Even in Glasgow a lack of gender difference was

reported. This study does not comment on the different phonetic contexts constraining glottal replacement.

No gender effect was also found by Stuart-Smith (1999) who reports mandatory use of the glottal variant in PreP and a recurrent usage in PreV as well as intervocalic positions in working class speech.

Recent research on glottal replacement has been carried out in Buckie by Smith and Holmes-Elliot (2017), with a sample of 24 speakers and a total number of 4,898 tokens coded for linguistic and social factors. The dependent variable was linguistically constrained by following phonetic segment (PreP and PreV)[29], ambi-syllabic segment (e.g. *bottle, bitten*) and onset position (e.g. *sometimes*), whist the independent variables explored were age and gender. Results display the following ranking:

Ambi#Syllabic consonant (e.g. *bottle*) > Coda#Vowel (e.g. *that is*) > Ambi#Vowel[30] (e.g. *pretty*) Coda#Pause (e.g. *I like that*.) > onset (e.g. *sometimes*).

What is surprising from this data is that the usual *highly* disfavouring ambisyllabic context, in Buckie, is the most favouring factor. This study displays a dramatic change in apparent time, from a minor percentage of [ʔ] in the older generation to a full 90 per cent among youngsters. A remarkable gender difference is only found among the older generation where males adopt the non-standard feature more frequently than women, yet this polarity appears to be levelled in the young generations. Finally, although glottal variants were usually blocked in prominent syllables, Smith and Holmes-Elliott (2017) highlight some exceptions, such as the teen numerals (e.g. *eighteen*) and the lexical item *sometimes*.

[29] The PreC contexts were excluded as /t/ might assimilate to a following non-sonorant consonant.
[30] V_V environment.

5.9 T-Glottaling beyond the British Isles.

This phonological feature has also been investigated in other English varieties, such as New Zealand English and American English.

Holmes (1999) examined word-medial and word-final /t/ glottaling in the speech of young (18-30) and middle-aged (40-55) speakers from New Zealand, reporting an increase of (t) glottaling lead by young informants. Glottal variants were found to be more frequent among working class speakers than their middle class counterparts, with women being in the lead in both classes. While glottal variants occurred at a higher rate word-finally, evidence of glottaling was also found in intervocalic position (both word medial and word final) even though not very frequently. Moreover, the pre-pausal environment turned out to be the most favoured context for /t/ glottaling to occur.

Roberts (2006) conducted the first study on /t/ glottaling in Vermont analysing 47 speakers, aged between 8 and 80. The change is led by males, particularly by 9 year-olds and teenagers. In terms of constraints, besides the following environment, the preceding context was also included in the analysis revealing that preceding vowels trigger glottaling, whereas preceding consonants inhibit it. As regards the following environment, pre-pause, pre-nasal and pre-glide favoured the glottal stop, whilst obstruents, vowels and liquids were marked as disfavouring factors.

To examine the variability of (t), Eddington and Taylor's (2009) study mainly focused on formal style, excluding informal speech and word-medial tokens. Their work included 20 collocations of word-final pre-vocalic /t/ constrained by frequency, preceding and following stress, preceding and following vowels, gender, age and, location. The 58 participants gathered were divided on the basis of geographical location: 22 speakers were from Western states, 20 were from Utah, and 16 from non-western states. Results show that only following vowel, age and region surfaced as

significant factors. With respect to following vowels, following high vowels had a significant effect, whereas following back vowels inhibited the use of glottal variants. As for age, young and middle-aged females (in their 20s, 30s and 40s) adopted glottaling more than males aged 20-30. As regards location, high frequency of glottal stops were found among Western speakers, rather than among Non-Western ones.

Eddington & Brown (2020) examined the production and perception of word-final and word-medial /t/ glottalization in five US states: Indiana, Mississippi, New Mexico, Utah, Vermont. The production study shows that age is the only significant social factor when /t/ occurs word-medially. /t/ in pre-nasal word-medial (e.g. *button*) is more likely to be produced as oral releases by young speakers than by their older counterparts. The preceding vowels of word-medial /t/ followed by nasals was found to condition glottalization, with /ɪ/ and /ə/ favouring oral releases and /æ/ and /ɒ/ disfavouring it. As for word-final /t/, age and gender are marked as significant predictors, with young speakers and women being more likely to realise /t/ as a glottal stop in the PreV environment. The perception study revealed that people who use glottal variants are considered less educated and less friendly.

5.10 Summary

At this point, the above literature review leads us to make some considerations. Firstly, some studies treat t-glottaling and t-glottalisation together (e.g. Tollfree, 1999), whilst others only focus on glottal replacement (e.g. Schleef 2013; Baranowski & Turton 2015; Smith & Holmes-Elliott 2017, etc.).

Secondly, as Schleef (2013: 205) claimed: “in some locations, T-glottaling is a new feature; while in other locations it is not.” It is evident, in fact, that t-glottaling is in the process of ongoing change in some parts of the UK, as revealed by generational

differences whereas, in other sites, it does not seem to be a new feature especially in specific phonetic contexts (e.g. PreC environment). In the PreC environment, indeed, the change seems to approach an endpoint due to high rate of occurrence and lack of gender differences. On the contrary, a more recent change can be observed in the most constraining and stigmatised environments, namely intervocalic position and in prominent syllables, where the glottal variant has started spreading and, as expected, it is rarely used by speakers belonging to the old generation. Moreover, since [ʔ] is the non-standard and stigmatised variant, it is not surprising to find males using it more (Labov, 2001). However, Milroy et al.'s (1994) findings from Newcastle show a higher rate of glottal variants for middle-class females than for middle-class males, and suggest that this may be associated with a supralocal change, as also observed in Cardiff (Mees & Collins, 1999).

Schleef (2013) proposes that the variability of /t/ was found not to be merely conditioned by phonological factors, but also by grammar which plays a notable role. The usage of glottal(ised) variants has also increased dramatically in all social classes and styles. However, as Altendorf & Watt (2008: 209) claim: "social differentiation is retained by differences in frequency and distribution of the glottal variant in different phonetic contexts". In the light of the above considerations, this study addresses the following research questions, as already outlined in Chapter 1:

Descriptive aims:

1) How does (t) glottaling behave in East Anglia?
2) Is the variability of word-final /t/ glottaling conditioned by phonological factors only?

- Since East Anglia is considered one of the places where the glottal stop has originated, the hypothesis is that the change, in this area, might be nearing completion.

3) Is word-medial /t/ behind word-final /t/ glottaling in the change?
    - The hypothesis is that word-medial /t/ glottaling might be behind word-final /t/ in the change, as the former includes intervocalic /t/ – a typically stigmatised phonological environment.
4) Do external (i.e. social) factors play a notable role?
    - The hypothesis is that social factors play a remarkable role if the change is not nearing the end.
5) Do Colchester, Ipswich and Norwich exhibit similar patterns?
    - Given the geographic proximity, the use of this feature is not expected to considerably diverge between the three localities.

Theoretical aims:

6) Is (t) glottaling governed by a universal sonority hierarchy in East Anglia?

Chapter 6 - (t) GLOTTALING: RESULTS AND DISCUSSION

This Chapter presents and discusses the results of the second linguistic variable investigated in this survey: (t) glottaling. Firstly, I will recap some coding procedures related to the linguistic constraints; secondly, I will briefly go through the analytical procedures adopted during the mixed-effects Rbrul regression analysis. I will then present the overall findings (the three locations together) and afterwards the results from each locality to observe whether the role of internal and external factors conform to the overall East Anglian pattern. Since the (t) database is split into two parts: word-final /t/ (WF) and word-medial /t/ (WM), the last two procedures will be repeated for both analyses.

6.1 Analytical procedure – linguistic constraints

As outlined, the phonetic environment which has received the greatest attention in the literature is the following phonetic segment – commonly divided into three main contexts: PreC (e.g. *that man*), PreV (e.g. *that apple*) and PreP (e.g. *what?).*

This study follows Roberts (2006), Eddington and Taylor (2009)[1], Schleef (2013), and Barrera (2015) in coding for both preceding and following environments. Roberts (2006) divided the consonant category into: obstruents, liquids, glides and nasals, and has also coded for vowels and following pause. Schleef (2013) maintained the same

[1] Both Roberts (2006) and Eddington and Taylor (2009) researched (t) glottaling in American English.

coding scheme for the following context but, in line with Barrera (2015), limited the preceding environment to vowels[2], nasals and liquids[3].

The current study, for both preceding and following phonetic segment, codes vowels as front, central and back. Trudgill (1974) shows that /t/-glottaling is blocked when followed by a schwa /ə/ or unstressed /ɪ/, hence, to better control the behaviour of preceding and following schwa /ə/ - provided the restriction of the rule application - central /ʌ/ was coded together with back vowels. It is unlikely that the reclassification of these few tokens would have a different statistical effect on these factor groups given the number of occurrences. Following consonants are distinguished between nasals, liquids, stops, fricatives and glides. The coding for the preceding environment is not only limited to the factor groups examined in previous studies, but along with vowels, nasals and /l/[4], I also included preceding stops, sibilant fricatives and non-sibilant fricatives. In the literature, preceding non-resonant consonants (e.g. *project, sister, chapter)* were found to block /t/- glottaling (Tollfree, 1999), hence they are usually excluded from analysis (Schleef, 2013). However, my hypothesis is that if there is a "rapid increase in the use of [ʔ] across all dialects studied to date in the UK" (Smith & Holmes-Elliott, 2017) and, for this reason, (t) glottaling is advancing so fast across geographical, social and linguistic constraints, it is likely that [ʔ] might have just started diffusing in those linguistic contexts where /t/ was categorically retained. After all, there are records in which the glottal stop occurs after a preceding stop, i.e. post-glottalization, which is generally considered a characteristic of broad accents, and occasionally referred to as basilectal (Cruttenden, 1994). Examples of post-glottalisation after /p, t, k/ are: *keeper* [kipʔə], *speaker* [spikʔə], *water* [watʔə], which

[2] Barrera (2015) distinguished between front, central and back vowels.
[3] Nasals and liquids were collapsed in Schleef's analysis.
[4] L- vocalised tokens are coded as vowels (e.g. *bolt* [bəʊt]).

typically occur in Tyneside (Wells, 1982). Even though the glottal stop does not occur in word-final consonant clusters in the above examples, they show that the sequences [pʔ], [kʔ] and [tʔ][5] can apply. Hence, /t/ after a preceding stop /p, k/ could potentially have a glottal gesture. Docherty et al. (1997: 290) report the use of glottal(ised) variants [ʔt] in words like *chapter, doctor*, where the rhymal consonant is a stop, but claim that "it is at present not clear whether the process also affects words like *after* and *custard* where the preceding rhymal consonant is a fricative." However, occasional glottal replacement [ʔ] of the labio-dental /f/ was found in Cockney (Cruttenden, 1994), and occasional glottalization after fricatives (e.g. *fifteen*) was reported by Hartley (1992) in the Tyneside adult conversational speech.

Consonant clusters excluded from analysis are *str-* (e.g. *stroke*) and /tr/ (e.g. *mattress*). In the latter, /r/ can syllabify with the preceding /t/, hence the alveolar stop is less likely to undergo glottaling[6]. Indeed, the few tokens containing /t/ in pre-liquid /r/ position were all near-categorically non-glottal(ised). Since there was no variation, they were excluded post-coding from the Rbrul analysis (Johnson, 2009). /t/ at the onset of a stressed syllable (e.g. *attack*) are typically excluded as the stress pattern blocks (t)-glottaling (Schleef, 2013). In this research, however, the *–ee/-oo* words such as *tattoo* and *seventeen* were taken into account, in line with the Manchester (Baranowski & Turton, 2015) and the Buckie studies (Smith & Holmes-Elliott, 2017) which show that the glottaling process is advancing in stressed positions[7].

[5] This type of glottalized pronunciation [tʔ] is also commonly found in Suffolk and Norwich (Trudgill, 1974).

[6] In this environment, pre-glottalisation (e.g. *mattress* [mæʔtrəs]), seems to be more common among English speakers (Wells, 1982).

[7] /t/ → [ʔ] lenition after preceding high and long front (-ee /i:/) or back (-oo /u:/) vowels have also been observed by Harris & Kaye (1990). As they highlight, these type of words (e.g.-*teen* items) are subject to the English Rhythm Rule, (Prince, 1983), according to which the secondary-primary stress pattern of a token (e.g. *fourteen*) turns into a primary-secondary stress pattern, if followed by a stressed word (e.g. *fóurtèen mén*) as a result of primary stress clash. These findings were also reported for West Yorkshire (Jeffries, 2011).

Word-medial /t/ was initially coded by syllable contexts, yet due to low number of tokens in some categories they were grouped together (see section 6.5. for further details). Tokens followed by the non-sonorant consonant /s/, such as *it's*, were excluded as [t] tends to assimilate to following segments. Similarly, occurrences with a following /t/ and /d/ were not coded. Finally, a maximum of 10 occurrences per speaker were coded for high-frequency words such as *it, at, but, out, that, not.*

6.2 Analytical procedure – Rbrul

Across the 36 informants interviewed, 3,051 and 1,872 tokens were respectively coded for /t/ in WF and WM positions. The number of occurrences analysed for the WF dataset averages 84.75 tokens per speaker, while 52 tokens per participant were extracted for the WM contexts.[8]

Rbrul is the statistical tool employed to carry out the mixed-effects regression analysis, with speaker and word as random effect. To spot the most relevant predictors and to detect any potential interaction, all factors were included in the first run. Once the salient predictors were identified, I carried out numerous cross-tabulations between the dependent variable and each linguistic factor to control for knock-outs. In the next step, I ran an interaction factor in Rbrul which revealed the interaction between style and the following phonetic segment, as discussed later in the chapter. Finally, a step-up/step-down regression analysis was carried out. The type of response is binary: /t/-glottaling vs. plain /t/, with /t/-glottaling as application value. Table 6.2.1 indicates the constraints and their related factor groups of the final model for both WF and WM /t/.

[8] In both cases, the number of occurrences exceeds the common statistical threshold (Guy, 1980).

Constraints	Factors
Preceding manner of articulation	nasals (e.g. *prevalent; printer*) sibilant fricative (e.g. *machinist; sixteen*) non-sibilant fricatives (e.g. *craft; fifteen*) /l/ (e.g. *Walt; multiple*) stops (e.g. *craft*; *factory*) high vowels (e.g. *quit; eighty)* mid vowels (e.g. *it; nightmare)* low vowels (e.g. *habitat; apartment*)
Following manner of articulation	nasal (e.g. *eat meet*; *nightmare*) fricatives (e.g. *favourite food; itself*) stops (e.g. *rent because; netball*) liquid (e.g. *newest little*; *completely*) glides (e.g. *brought you*; *Gatwick*) high vowels (e.g. *updated*) mid vowels (e.g. *upset about*; *potato*) low vowels (e.g. *went on; regret and)* pause (e.g. *what?*)
Syllable stress	Primary stress – (t) occurs in primary stressed syllables (e.g. *sit; eighteen*); Non-primary (e.g. *operate; community*)
Style	Spontaneous speech, reading styles, word lists
Word frequency	low frequency (1-3); high frequency (4-7)[9]
Social class	working class, middle class
Age	young (18-28), middle (35-50), older (60+)
Sex	female, male

Table 6.2.1 Constraints on the (t) variable for the WF and WM dataset.

6.3 Overall Results and Individual Variation for word-final /t/

This section outlines the overall results of word-final /t/ and presents the step-up/step-down regression analysis of the above model reporting the findings from the three localities together. The figure below reveals that /t/ glottaling in word final context is well-distributed across class, sex and age. Working class males lead the young group

[9] Word frequencies presented as Zipf- values can be divided into low-frequency words (values 1-3) and high-frequency words (values 4-7) (Van Heuven et al., 2014).

with 83% of glottal realisations; women of both classes are slightly ahead among middle-aged speakers; whereas the least glottal realisations were found among middle class females in the old group.

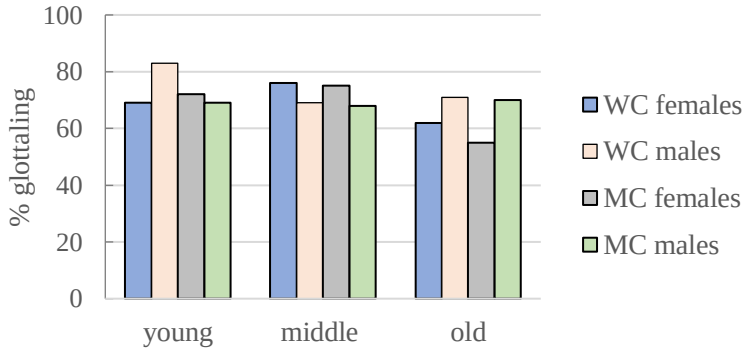


Figure 6.3.1 Overall results for word-final /t/ glottaling.

Having delineated, in brief, the profile of word-final /t/ in East Anglia, let us turn the attention to the mixed-effects regression analysis for an in-depth discussion of the findings. Model comparison was carried out through a log-likelihood ratio test, and the best model achieved in the multivariate analysis shows that preceding environment, following environment and style are marked as significant predictors. Class, sex and age do not exhibit statistically significant responses. The lack of social effect is consistent with recent research carried out in both London and Edinburgh (Schleef, 2013), yet they do not match those studies in which (t) glottaling has a social effect (e.g. Smith & Holmes-Elliott, 2017)[10] - this issue will be addressed later in the chapter.

[10] Despite the social effect found in Buckie, these social influences were weakening over time.

Application value = glottaling; overall proportion = 0.703				
R^2 = 0.599; log likelihood = -1125.923; *N* = 3051				
Constraints	**Logodds**	**FW**	**%**	**Tokens**
Preceding environment				
p<.001				
central vowel	1.985	0.88	95	37
front vowels	1.099	0.75	80	762
back vowels	0.887	0.71	79	1411
nasals	0.846	0.70	74	350
/l/	0.446	0.61	57	94
stops	-2.062	0.113	23	126
fricatives	-3.201	0.039	18	271
Style				
p<.001				
spontaneous speech	1.656	0.84	82	2091
reading styles	0.083	0.521	53	615
word lists	-1.739	0.149	30	345
Following environment				
p<.001				
nasals	2.285	0.908	91	87
liquids	0.688	0.665	94	107
glides	0.553	0.635	87	271
stops	0.481	0.618	91	233
fricatives	-0.066	0.484	80	421
central vowel	-0.597	0.355	79	227
pause	-0.951	0.279	50	1069
front vowels	-0.962	0.276	75	533
back vowels	-1.432	0.193	62	103

Table 6.3.1 Multivariate analysis of (t) glottaling in the whole dataset.

Table 6.3.1 reports no significant effect of lexical frequency for word-final /t/. The following sections draw the attention to those predictors that surfaced in the mixed-effects regression analysis and discusses factor groups in order of significance.

6.3.1 Preceding environment - word-final /t/

The most powerful constraint for word-final /t/, in East Anglia, is the preceding environment. As detailed in Chapter 5, most of the studies on (t) glottaling have limited

the preceding context to vowels. Despite the restriction on the use of [ʔ] before and after a schwa /ə/ (Trudgill, 1974), Table 6.3.1 shows that, amongst vowels, a preceding schwa /ə/ promotes the most glottaling (.88). Crosstabulations revealed that 82% of tokens with a preceding /ə/ occurred in unstressed syllables. But does this also hold for Norwich? (this question will be answered in section 6.4.3). Front vowels are the second most favouring segment with a probability of .75, followed by back vowels which favour at .71 and have the highest token number. It is interesting to note the strong influence of preceding vowels since they are not divided by any other factor group in the hierarchy. Vowels also exhibit the highest effect size amongst Edinburgh (.67), London's teenagers (.61) (Schleef, 2013), and in Vermont English (.57) (Roberts, 2006), while in RP the use of [ʔ] is only favoured by back vowels (.57) - front and central vowels disfavour it (Barrera, 2015). In phonological theory, front vowels and coronal consonants are deemed to be members of the natural class of coronal sounds (Clements and Hume, 1995). Hence, /t/ is more likely to be realised as a coronal feature rather than with a glottal stop which differs in the place of articulation. However, even though front and central vowels were marked as disfavouring factors in RP (Barrera, 2015), Barrera reports a visible variability. This means that not only has (t) glottaling spread from one linguistic environment to another (e.g. after a preceding schwa /ə/), but has also spread, in the same linguistic contexts, to more formal or statusful varieties. This would explain the high use of [ʔ] after certain central and front vowels in East Anglian English, and it would suggest that the diffusion of glottal variants after a preceding schwa has completed its linguistic change in the vernacular, at least in East Anglia.

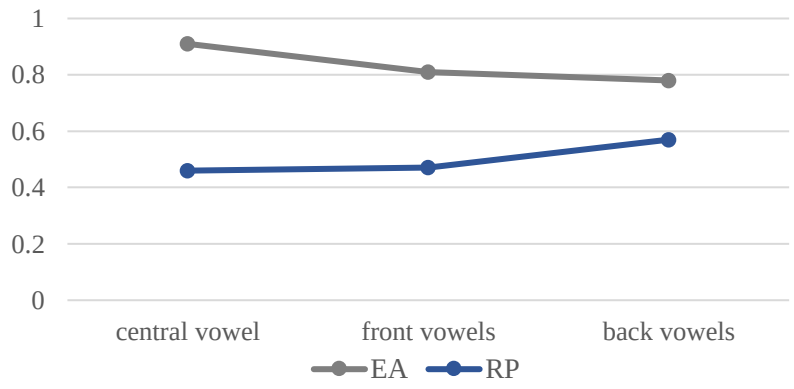


Figure 6.3.2 Probability of WF /t/ glottaling between EA and RP.

The fourth most favouring effect on (t)-glottaling concerns nasals[11]. The difference in probabilities between nasals (.70) and low vowels (.71) is negligible, suggesting that the distinction between these factor groups might not be relevant. Laterals are the last favouring preceding predictor to trigger glottal(ised) variants. By contrast, Schleef (2013) found nasals and liquids to inhibit (t)-glottaling, confirming Roberts' (2006) findings where preceding consonants disfavoured [ʔ] at .34. Trudgill (1974) reported analogous findings in Norwich English with no [ʔ] in the /n_/ and /l_/ contexts, as in *went* and *felt*. Preceding stops, as expected, favour /t/ retention and disfavour /t/ glottaling at .113. Fricatives have the lowest probability resulting in .039. In this study fricatives are not treated separately (sibilants vs. non-sibilants) as a likelihood ratio test of the model with combined fricatives against the model with separate fricatives did not reveal a significant difference between models (x^2 (1) = 0.16, p > .05).

No comparison can be made with previous studies with respect to preceding stops and fricatives – they were usually excluded as obstructing (t)-glottaling[12]. This research reports a slightly visible variability of glottal variants when /t/ is preceded by stops /p,

[11] The nasal category mainly refers to /n/ (n = 350) which hugely outnumber preceding /m/ (n = 3).
[12] A further run not shown here, reveals that when stops and fricatives are excluded from the analysis, nasals and preceding /l/ disfavour glottaling, along the line of Schleef's (2013) study.

k/ and fricatives /f, s/, yet they all remain the most inhibitory factors for (t) glottaling to occur. Since [ʔ] is dramatically spreading, and since diffusion can also occur linguistically (from one environment to the other) (Straw & Patrick, 2007), the use of glottal stops in these contexts might be accounted for as an early stage diffusion into another linguistic environment.

From a theoretical standpoint, the sonority hierarchy seems to be a partial explanatory factor as more preceding sonorous segments favour glottal(ised) variants, while less sonorous segments disfavour it. The sonority scale, which refers to the ranking of speech phones by amplitude, is proposed by Goldsmith (1990) and Laver (1994) as follows: (most sonorous) vowel > glide > liquid > nasal > fricative > affricate > stop/plosive (least sonorous)[13].

This ranking is nearly parallel to the East Anglian findings with preceding vowels favouring (t) glottaling, while a reverse order occurs with respect to nasals and /l/, as well as stops and fricatives. The exchange of place between nasals and liquids, in terms of sonority, should not be problematic given the small probability difference between them. If we explore in more detail the sonority scale within the vowel system, we also find a reversed order to what is theoretically predicted: (most sonorous) low open vowels > mid vowels > high close vowels (least sonorous) (Laver, 1994). However, the present study shows mid vowels at the top of the ranking followed by front and back vowels.

[13] This phonotactic principle, whose purpose is to describe the structure of a syllable in terms of sonority, is known as *Sonority Sequencing Principle* (SSP). For an in-depth discussion on the syllable structure (onset, nucleus and coda) see Goldsmith (1990) and Laver (1994).

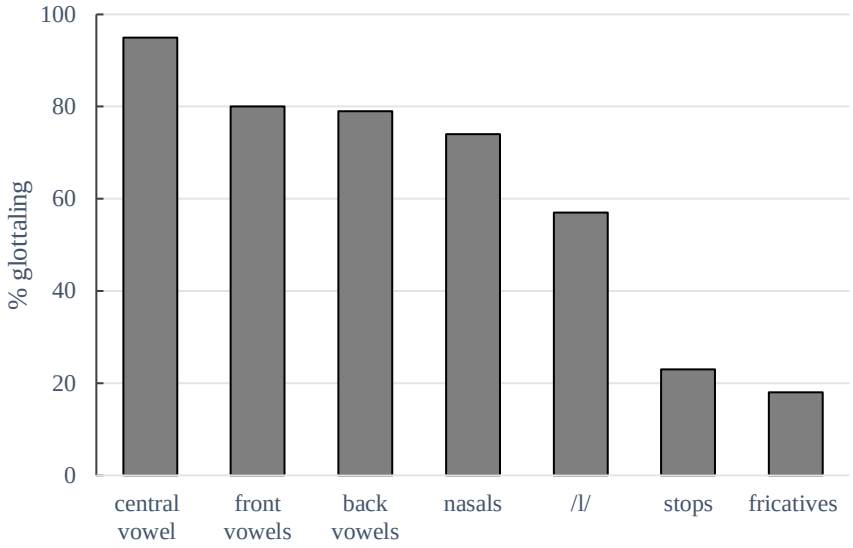


Figure 6.3.3 Rates of /t/ glottaling for the preceding environment.

6.3.2 Style-shifting in word-final /t/

The style-shifting analysis seeks to investigate the distribution of the (t) variable in conversational and controlled speech. It is argued that when speech is unselfconscious, the style is closer to the vernacular, while when speech is more self-conscious it will be more closely to the standard variety (Labov, 1966). Trudgill (1974) demonstrates that the glottal(ised) variants, in Norwich English, are inversely proportional to social class and social context. High classes in formal style exhibit low levels of glottalization, whilst lower classes glottal(ise) more frequently in spontaneous speech. Interestingly, Trudgill's (1988) real time study revealed that the variable (t), intervocalically and in word-final /t/, slightly increased in casual style. Conversely, in more formal styles there was a dramatic spread suggesting how "a change having gone almost to completion in casual speech, continues to spread from style to style" (Trudgill, ibid: 44). Holmes-Elliott's (2019) real time study in Hastings, which explores the development of (t)-

glottaling (among other linguistic variables)[14] from childhood to adolescence, found higher rates of glottaling with individuals showing convergence over time and moving in the same direction. The significant effect of style, in Hastings, shows lower rates in more formal contexts[15]. Figure 6.3.4 displays the distribution of (t) across style-shifting, which is the second most significant constraint in the present analysis.

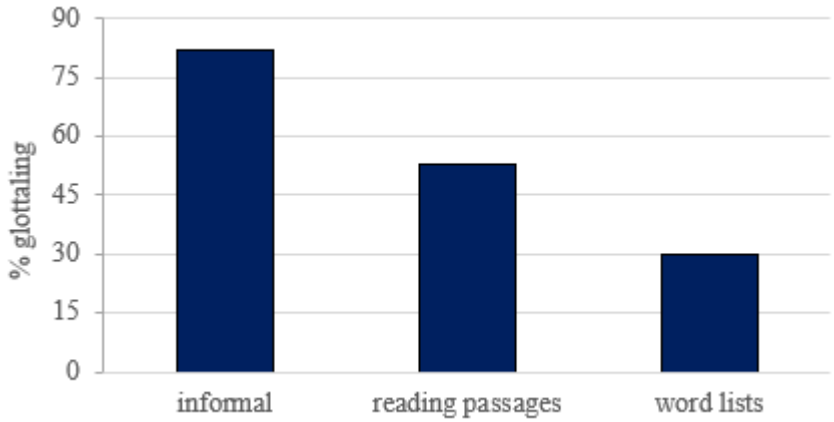


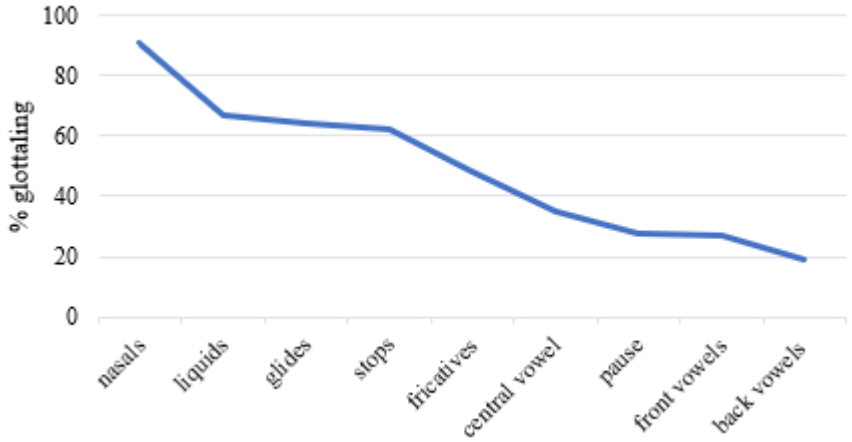
Figure 6.3.4 Rates of (t) glottaling by three speech styles.

This outcome, which shows that the (t) variable is highly sensitive to style-shifting, corroborates Trudgill's (1988) findings and it is in line with previous studies (Milroy et al. 1994; Tollfree 1999; Williams & Kerswill 1999; Mees & Collins 1999; Stuart-Smith et al. 2007). Indeed, the graph illustrates a very high rate of glottal(ised) variants in spontaneous speech, followed by reading passages - where the use of [ʔ] is almost in a neutral position (.52) - and the word lists, which are marked as a disfavouring factor. The question whether /t/-glottaling is losing its stigma remains open, since it is "increasingly tolerated in more careful register" (Kerswill & Williams, 2000) and it is

[14] This real time study also includes: GOOSE fronting, TH-fronting and /s/-realisation (Holmes-Elliott, 2019).
[15] Kerswill & Williams (2000) argue that "children slowly gain sociolinguistic maturity in a manner that involves a gradual increase in the number of styles that are perceived and treated in an adult way".

diffusing to more formal styles in younger speakers (Stuart-Smith 1999; Marshall 2002).

Conversational speech style and preceding environment. It has been proven that linguistic changes begin in the vernacular spontaneous speech before continuing to spread from style to style (Trudgill, 1988). Along this line, figure 6.3.5 illustrates the distribution of word-final /t/ by preceding phonological environment in casual speech.



. Figure 6.3.5 WF (t) glottaling by preceding environment in casual speech.

If glottal(ised) variants were previously found not to occur before and after a schwa (Trudgill, 1974), in the present sample [ʔ] is strongly promoted by all vowels, regardless of their highness or backness, and a preceding schwa leads the hierarchy.

The position of nasals and /l/ in the hierarchy is noticeable as are their high glottaling rates. Stops, non-sibilant and sibilant fricatives occupy the last places in the ranking, but they still show evidence of glottaling whose rate does not go below 26%. Let us now explore the (t) variable by following phonetic segment.

6.3.3 Following environment in word-final /t/

As previously discussed, the bulk of research on the (t) variable has mostly focused on the following phonetic segment, which is considered the most fruitful constraint. This ruling predictor, called the *diffusion pattern* after Straw & Patrick (2007), refers to the ordering of diffusion in different linguistic contexts: PreC > PreP > PreV. This pattern is repeated in many southern communities, such as London (Hudson & Holloway 1977; Tollfree 1999; Schleef 2013), Milton Keynes (William & Kerswill 1999) and in many northern places such as Derby (Foulkes &. Docherty 1999a), Hull (Williams & Kerswill 1999), and Edinburgh (Schleef, 2013). In the Manchester data, PreC leads the ranking, yet no significant difference was found between PreP and PreV (Baranowski & Turton, 2015). Previous research (e.g. Trudgill, 1974) shows that the use of glottal stops and glottal(ised) variants is very common in Essex, Suffolk and Norfolk (Trudgill, 1974), however, as Straw & Patrick (2007: 392) note, "the [linguistic] environments have not previously been applied to glottal variation in East Anglia".

In 2007, these environments were adopted to constraint the (t) variable in Ipswich, where the PreV context was found to favour glottal variants the most, as the following ranking shows: PreV > PreC > PreP. Since this hierarchy differs from the *diffusion pattern*, it is referred to as the *Ipswich pattern* (after Straw & Patrick 2007).

The extension of the following phonetic segment in some British dialects shows the following rankings for word-final /t/ glottaling:

in London (Schleef, 2013):

nasal (.74) > liquid (.64) > fricative and affricate (.53) > plosive (.45) > glide (.41) > pause (.37) > vowel (.34)

in Edinburgh (Schleef, 2013):

nasal (.78) > fricative and affricate (.68) > liquid (.54) > plosive (.48) > glide (.46) > pause (.43) > vowel (.16).

The overall results from the present East Anglian study confirm the *diffusion pattern*, with more glottaling in PreC than PreP and PreV. However, when the vowel category is subdivided a following schwa precedes pause in the hierarchy. Figure 6.3.6 shows that, in the following environment, nasal (.908), liquid (.665), glide (.635) and stop environments (.618) favour the glottal(ised) variants, while fricative (.484), central vowel (.355), pause (.279), high vowel (.276) and low vowel environments (.193) disfavour it. The social distribution in this context does not reveal prominent results, besides all social factors, statistically, do not play a role. In Tyneside, on the contrary, word-final /t/ pre-vocalically was found to be more common among young middle-class men.

Following pause is usually referred to as an arbitrary facor for (t,d) (Patrick, 1991) as deletion of apical stops, after a pause, varies across localities. Similarly, pause appears to be localised even for the distribution of (t) glottaling as glottal(ised) variants do not occur when followed by a pause in Tyneside (Docherty et al., 1997), in London (Schleef, 2013), in Edinburgh (Schleef, 2013), yet this predictor holds true for Milton Keynes (Kerswill & Williams, 1992). Similarly, working-class adults in Glasgow retain their categorical use of glottals when /t/ occurs before a following pause (Stuart-Smith, 1999).

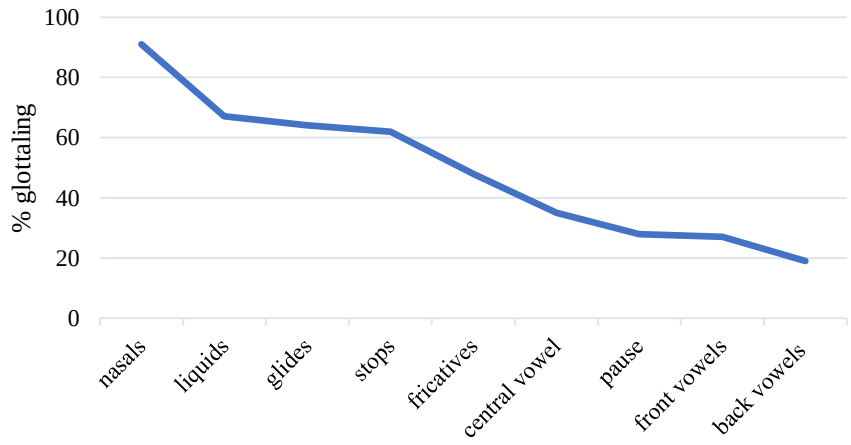


Figure 6.3.6 Rates of (t) glottaling by following environment.

The high rates of glottal variants before a following nasal or a liquid is comparable to the London and the Edinburgh studies. By way of contrast, in East Anglia, the place of glides and fricatives is reversed: the former favours (t) glottaling, whereas the latter disfavours it.

The high position of glides should not be surprising as the probability of glottaling in this context is already well-established in RP, where glides are the second most favouring predictor (.63) (Barrera, 2015). However, the low place of fricatives in East Anglia remains a mystery, for now, since (t) glottaling before this phonetic environment has recently been attested even in RP (Barrera, 2015).

Due to the low position of vowels in the hierarchy, the *Sonority Sequencing Principle* could not be adopted to explain the ranking of the following environment.

An additional theory on the sonority hierarchy, known as the *Dispersion Principle*, suggests that "a language will preferentially maximize sonority difference in the syllable onset, but minimize it in the coda" (Clements, 1990: 177). Even in this case, a following vowel – at the onset – maximises sonority and does not apply to the data discussed here. Perhaps, sonority simply does not govern word-final /t/-glottaling.

Conversational speech style and following environment. Let us now explore the distribution of word-final /t/ for following phonetic segment in casual speech.

Figure 6.3.7 displays a rate which goes above 85% before nasals, liquids, stops and fricatives; while the graph line decreases when glottal(ised) variants are followed by a schwa, pause, front and back vowels. This, as expected, suggests that the use of glottal(ised) variants in PreC has nearly completed its linguistic change. Indeed, it has been proven that word-final /t/-glottaling, in the PreC environment, is also well-established in RP (Fabricius 2000; Kerswill 2007; Barrera 2015). Fabricius (2000)

comments on the loss of stigma of word-final pre-consonantal /t/-glottaling having reached the young upper-middle class generation.

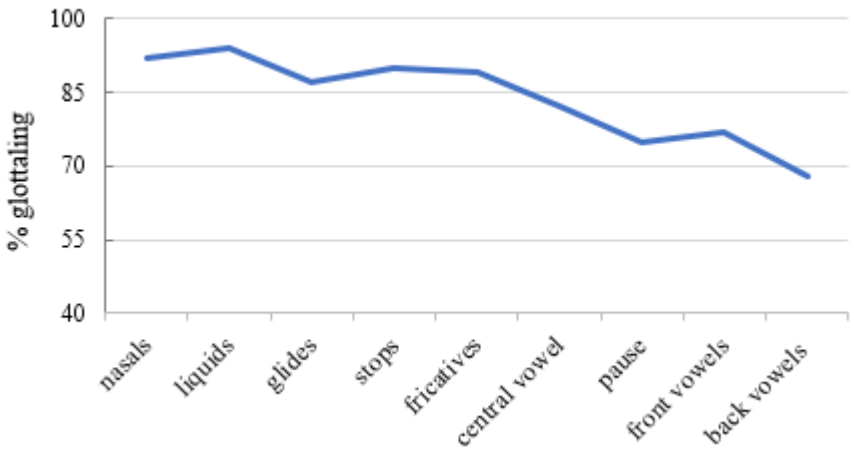


Figure 6.3.7 Rates of (t) glottaling by following environment in casual speech.

A closer examination of the distribution of glottal(ised) variants in casual speech reveals that fricatives exhibit a high rate of glottaling behaving like other following consonants. This reconfirms that (t) is sensitive to style-shifting and shows how phonetic environments vary according to speech style.

6.3.4 Non-significant factors – overall findings for word-final /t/

The correlation between speech style and social variables has long been a key for (t)-glottaling. However, this study does not report a significant effect for any of the social predictors investigated. Why? The lack of statistical significance of social factors has recently been reported in Manchester (Baranowski & Turton, 2015)[16], in London, Edinburgh (Schleef, 2013) and Hastings (Holmes-Elliott, 2019).

[16] Age is a significant factor in Manchester. See Baranowski & Turton (2015) for further details.

It is argued that the absence of social class and gender significance of a variable suggests that the advanced change is nearing the completion (Baranowski & Turton, 2015). Appendix II displays statistical details from Rbrul one-level analysis. Despite being non-statistically significant, sex, age and social class are in the right direction that we would expect. The youngsters are slightly ahead of middle-aged, while old speakers fall behind. Indeed, Trudgill (2004a) notes that this supralocal consonant feature is on the increase among young East Anglian speakers. This trend is illustrated in figure 6.3.8. showing the distribution of /t/-glottaling across individuals (with the young at the left), whose proportion of the variance equals 0.487.

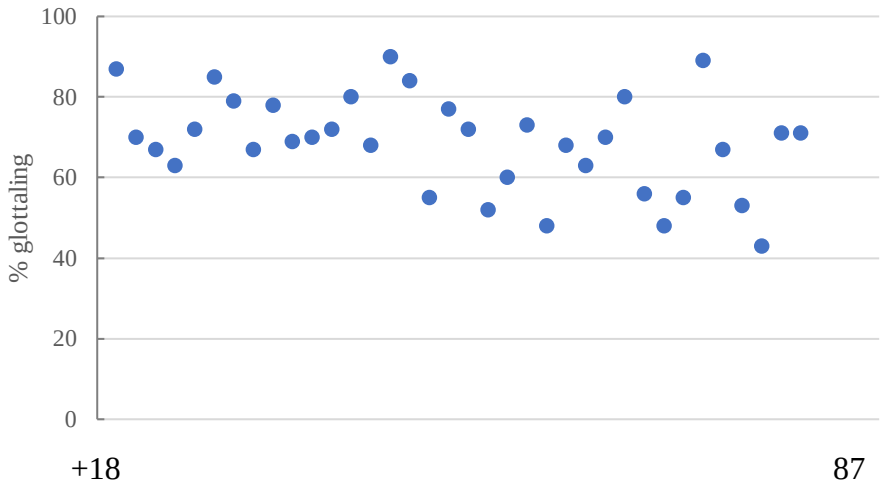


Figure 6.3.8 Rates of WF /t/ glottaling by individuals' age.

Males glottal(ise) /t/ more than females, whereas middle-class speakers fall behind working-class ones. However, in some speech communities (e.g. Cardiff) young middle-class speakers were found to promote glottaling the most (Mees & Collins, 1999). The change from above for Cardiff, where glottals are borrowed, contrasts with the old change for East Anglia where glottals are not a borrowing, hence not a change from above.

The correlation between sex and class did not exhibit noteworthy results, yet the relationship between age and class, as in figure 6.3.9, shows that: (1) young working-class speakers glottal(ise) the most; (2) the degree of glottaling between middle and working-class middle-aged speakers is levelled, while (3) old speakers use the glottal stop [ʔ] to a smaller extent. Altendorf (2003: 91) argues that: "T glottalling has increased in all social classes[17], styles and phonetic contexts in London and the south-east … where it is now very widespread indeed."

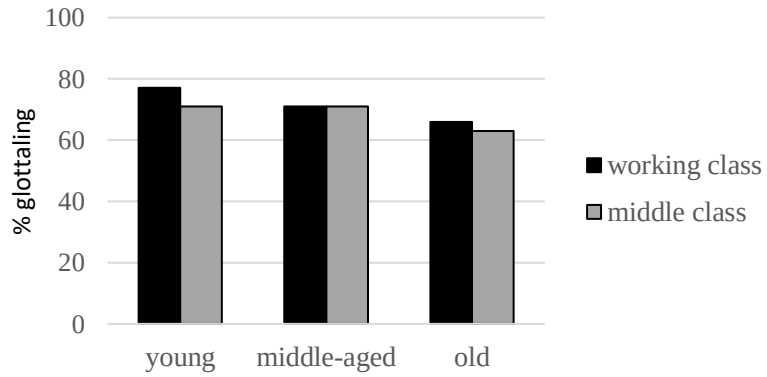


Figure 6.3.9 Rates of word-final /t/ glottaling by class and age.

Previous research demonstrated that (t) glottaling is a well-established local variable with a long history of use in certain sites, despite the evaluation of some more recent change. East Anglia, indeed, is considered one of the geographical areas where the glottal stop started spreading first – from Norwich to London (Trudgill, 1999). Origin aside, given the long presence of the glottal feature in this geographical and linguistic area, it is not surprising that the three localities investigated behave similarly. Results from one-level analysis display a high use of glottals in Ipswich > Colchester > Norwich, with Norwich showing the smallest amount of [ʔ], but not significantly. The

[17] Note that Altendorf (2003) defined social class merely by type of school: working-class speakers attended comprehensive schools, while middle-class speakers were those who attended grammar schools.

fact that Norwich exhibits lower rates of glottaling might be due to the relatively lower number of tokens extracted from this city. The last predictor which did not reach statistical significance is lexical frequency. In this analysis, lexical frequency is binary: high frequency words vs. low frequency words. The former refers to the $SUBTLEX_{UK}$ Zipf-values 4-7, whilst the values attached to the latter are 1-3.

Finally, in the attempt to answer the question posed at the beginning of this section - why don't social factors play a salient role? – I believe that the lack of social effect in East Anglia is not really surprising if compared to contemporary studies, and it adds to the general 'loss of stigma' argument.

So far, we have presented and discussed the results from the three locations together to gain an overall understanding of the behaviour of (t) in the linguistic East Anglia area. Let us now examine each location separately to monitor the consistency of linguistic and social constraints across geographical space.

6.4 Treating the three localities separately

The overall findings revealed that linguistic constraints and style trigger glottaling the most in East Anglia. The preceding environment proved the most fruitful constraint in terms of effect size and linguistic diffusion, showing that [ʔ] has spread into other phonetic contexts (e.g. after a preceding schwa /ə/). The following phonetic segment reported analogous findings with respect to the internal diffusion of glottals, which is also conditioned by style-shifting. Since the three localities are sited in what Trudgill (2001a) defines as 'linguistic East Anglia', we would expect Colchester, Ipswich and Norwich to conform, overall, to the East Anglian pattern. However, internal difference might surface in the behaviour of word-final /t/ when the three localities are investigated separately.

6.4.1 Results from Colchester – word-final /t/

Results from the multivariate multiple regression analysis with speaker as random effect show that the most powerful predictors in order of significance are style, preceding environment, following environment, as illustrated in table 6.4.1.

Style. In Colchester, /t/-glottaling is distinctly conditioned by style-shifting, indeed it is the most favouring constraint. As expected, results from style-shifting match the overall pattern with /t/ being more likely to glottal(ise) in spontaneous speech than in more formal style, whilst in words lists /t/ is more likely to be realised as an alveolar stop.

Preceding environment. The second most favouring predictor is the preceding phonetic segment with a marginal change at the top of the ranking, compared to overall findings.

(1) East Anglian pattern:

central vowels > front vowels > back vowels > nasals > /l/ > stops > fricatives

(2) Colchester:

front vowels > central and back vowels > nasals > /l/ > stops > fricatives

In Colchester, high vowels favour (t)- glottaling slightly more than central and back vowels. It has to be noticed that in the Colchester dataset, central and back vowels were grouped together in the preceding environment owing to the low number of tokens in the mid category and due to the similarities in terms of probability weight between the two factor groups. The rest of the hierarchy matches the East Anglian pattern, with stops and fricatives as disfavouring factors.

Application value = glottaling; overall proportion = 0.726 R^2 = 0.644; log likelihood = -349.502; *N* = 1097				
Constraints	**Logodds**	**FW**	**%**	**Tokens**
Style ***** p<.001**				
spontaneous speech	2.096	0.890	87	769
reading styles	0.028	0.507	49	206
word lists	-2.121	0.107	23	122
Preceding Env. ***** p<.001**				
front vowels	1.035	0.738	81	544
central & back vowels	1.030	0.737	78	277
/l/	0.928	0.717	65	20
nasals	0.684	0.665	69	118
Stops	-1.441	0.191	27	41
fricatives	-2.236	0.097	32	97
Following Env. ***** p<.001**				
nasals	2.840	0.945	93	29
liquids	1.063	0.743	98	42
glides	0.693	0.667	91	92
stops	0.182	0.545	89	73
fricatives	-0.188	0.453	83	169
central vowels	-0.833	0.303	83	77
pause	-1.002	0.268	52	378
front vowels	-1.054	0.258	78	200
back vowels	-1.700	0.155	65	37

Table 6.4.1 Multivariate analysis of WF /t/ glottaling in Colchester.

Following environment. The following phonetic segment is marked as the third significant predictor to condition (t). Factor groups within this constraint influence (t) glottaling in the same probability order as the overall East Anglian pattern, matching the diffusion pattern[18]:

PreC > PreP > PreV.

[18] Barring the inclusion of glides among consonants.

As discussed in section 6.3.4, none of the external factors, style aside, reached statistical significance when the three areas were combined; this result still holds for Colchester when it is separately analysed. Let us now turn the attention to the second site investigated: Ipswich.

6.4.2 Results from Ipswich – word-final /t/

This section reports the results from a step-up/step-down regression analysis, with preceding environment, following environment and style, as illustrated in table 6.4.2.

Preceding environment. In Ipswich, the greatest effect is contributed by the preceding phonetic segment, with central & back vowels (.832), nasals (.80) and front vowels (.735) favouring glottal(ised) variants, whilst /l/ (.493), stops (.126) and fricatives (.071) exhibit a negative correlation. These findings go in the direction of the overall East Anglian pattern, despite slight ranking differences.

(3) East Anglian pattern:
central vowels > front vowels > back vowels > nasals > /l/ > stops > fricatives

(4) Ipswich
back vowels > nasals > front vowels > /l/ > stops > fricatives.

Vowels, in Ipswich, are separated by nasals, and back vowels trigger slightly more glottaling than front vowels. It has to be noticed that central vowels have been excluded from the regression analysis as the use of the glottal stop in this context turned out to be categorical. This provides additional empirical support to the linguistic diffusion of [ʔ] (e.g. after a preceding schwa). The exchange of place in hierarchy between sibilant and non-sibilant fricatives is not statistically relevant.

Following environment. The second most powerful constraint is the following context, with nasals (.957), glides (.668), stop (.586) and liquids (.565) promoting the use of the glottal stop, while fricatives (.49), vowels (.37, .252, .161) and pause (.247) do not encourage (t)-glottaling.

(5) East Anglian pattern:

nasals > liquids > glides > stops > fricatives > central vowels > pause > front vowels > back vowels

(6) Ipswich:

nasals > glides > stops > liquids > fricatives > central vowels > pause > front vowels > back vowels

Previous studies show that nasals and liquids are the most preferable environments for [ʔ] to occur, whereas glides and plosives were found to disfavour glottal(ised) variants in both London and Edinburgh (Schleef, 2013). However, the high place of glides and stops in the above hierarchy confirms the strong effect of these predictors in East Anglia - in Ipswich in particular - where glides and plosives separate nasals and liquids, as in (6). Straw & Patrick (2007) demonstrate that, in Ipswich, word-final /t/ does not follow the usual *diffusion pattern* (PreC > PreP > PreV), yet the apical stop is more likely to be glottal(ised) before following vowels than before following consonanta and pause yielding the following ranking: PreV > PreC, PreP – which is referred to as the *Ipswich pattern* (after Straw & Patrick, 2007)[19]. By contrast, the findings from the present study are not analogous to the *Ipswich pattern*, as all vowels strongly disfavour /t/-glottaling.

[19] This pattern was found amongst Ipswich Anglo urban speakers, whereas the use glottal variants for Barbadians was higher in PreP position.

Application value = glottaling; overall proportion = 0.729 R^2 = 0.469; log likelihood = -469.458; *N* = 1114				
Constraints	**Logodds**	**FW**	**%**	**Tokens**
Preceding Env. **p<.001**				
central & back vowels	1.601	0.832	83	317
nasal	1.389	0.80	79	155
front vowels	1.021	0.735	78	488
/l/	-0.030	0.493	47	19
stops	-1.414	0.196	29	52
fricatives	-2.567	0.071	19	83
Following Env. **p<.001**				
nasals	3.110	0.957	97	40
glides	0.700	0.668	90	95
stops	0.348	0.586	95	81
liquids	0.263	0.565	95	37
fricatives	-0.039	0.49	84	146
central vowels	-0.530	0.37	83	78
front vowels	-1.087	0.252	77	198
pause	-1.115	0.247	51	405
back vowels	-1.650	0.161	64	34
Style **p<.001**				
spontaneous speech	1.394	0.801	83	760
reading styles	0.038	0.506	54	244
word lists	-1.392	0.195	43	110

Table 6.4.2 Multivariate analysis of word-final /t/ glottaling in Ipswich.

Style. Another significant constraint which helps explaining the variability of (t) glottaling, in Ipswich, is style.

6.4.3 Results from Norwich – word-final /t/

Similar findings, with respect to style, were found in Norwich. Table 6.4.3 reports the results from a multivariate analysis, with preceding environment, following environment and style marked as significant predictors in the conditioning of (t).

Application value = glottaling; overall proportion = 0.716 R^2 = 0.559; log likelihood = -296.004; *N* = 749				
Constraints	**Logodds**	**FW**	**%**	**Tokens**
Preceding Env. **p<.001**				
central and back vowels	1.239	0.775	79	205
front vowels	1.052	0.741	75	379
nasal	0.900	0.711	69	77
/l/	0.363	0.59	58	55
stops	-3.555	0.028	9	33
Following Env. **p<.05**				
nasals	1.705	0.846	81	16
stops	0.927	0.717	93	74
liquids	0.830	0.696	96	26
glides	0.427	0.605	85	76
fricatives	-0.147	0.463	75	98
central vowels	-0.568	0.362	81	63
pause	-0.993	0.27	53	249
front vowels	-1.072	0.255	76	117
back vowels	-1.110	0.248	60	30
Style **p<.001**				
spontaneous speech	1.538	0.823	84	491
reading styles	0.182	0.545	63	145
word lists	-1.721	0.152	25	113

Table 6.4.3 Multivariate analysis of word-final /t/ glottaling in Norwich.

Before comparing the above results to the East Anglian pattern, we should draw attention to the number of tokens analysed in this research site. The original number of tokens for word-final /t/ in Norwich equalled 840. However, in the pre-fricative context (n = 91) /t/ was categorically retained, hence these occurrences were excluded from the regression analysis, giving a total of 749 with an average of 62 tokens per speaker. Central vowels were collapsed with back vowels as, in this environment, /t/ was nearly

categorically glottal(ised). It is unlikely that this would have a significant statistical influence, given the very low tokens in the central vowel category (n = 10).

Preceding environment. Results from Norwich are near identical to the East Anglian pattern: central and back, as well as front vowels (.775, .741) strongly favour the glottal stop [ʔ] along with nasals (.711) and /l/ (.59), while stops (.028) strongly disfavour it.

Following environment. The second greatest effect is contributed by the following phonetic context with nasals (.846) at the top of the ranking followed by stops (.717), liquids (.696), and glides (.605) which exhibit a positive correlation; similar to Ipswich, stops precede liquids in the ranking, whereas fricatives (.463), vowels (.362, .255., .248) and pause (.27) consistently disfavour /t/-glottaling even in Norwich. Interestingly, pause, which seems to be a localised constraint (Docherty et al., 1997), consistently disfavours (t) glottaling in Colchester, Ipswich and Norwich.

It is not surprising that certain following vowels disfavour [ʔ] as previous studies carried out in Norwich reported some restrictions on the application of the diasystemic rule: /t/ ⟶ x <[t] ~ [tʔ] ~ [ʔ]> (Trudgill, 1974). As discussed early in the chapter, one of the limitations refers to the use of the glottal stop after a preceding schwa. However, the present survey has demonstrated that (t) glottaling in this linguistic environment has completed the change in East Anglia, as this finding was consistent in all three localities. Moreover, /t/-glottaling after a preceding schwa has been recently attested even in RP (Barrera, 2015). The second restriction concerns the following environment: /t/-glottaling is blocked when followed by a schwa /ə/ or unstressed /ɪ/, as in *put it* [pʰotʻəʔ], yet in the case of stressed /ɪ/ the glottal stop can apply as in *went into*. Schematically, Trudgill (1974: 175) summarises the rule as follows:

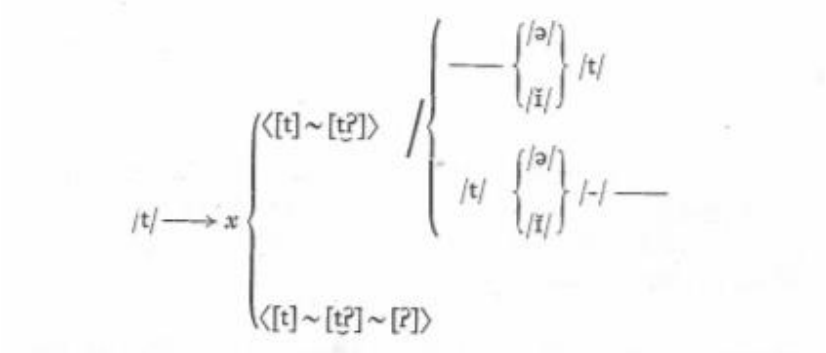


Figure 6.4.1 Restrictions on the application of (t) glottaling. Adapted from Trudgill (1974).

This second restriction is consistent with the findings of the present study. So far, we have presented and discussed the findings from word-final /t/ in East Anglia, as a linguistic area first, and secondly, we have investigated the three urban areas separately to verify the consistence of constraint ranking. Let us now explore /t/ glottaling in word-medial position.

6.5 Overall results and individual variation for word-medial /t/

This section draws attention to word-medial /t/ from the whole East Anglian dataset. The findings suggest that the change in status of /t/ glottaling in word-medial position is behind that of /t/ glottaling in word-final environments due to the lower rates of rule application and to the noticeable variation across social variables. Despite the differences between socio-economic classes, this predictor does not play a significant statistical influence on this variable. Males of both classes are in the lead among the young group where the least glottal realisation occurs among middle class females (22%); middle-aged speakers seem to use a relatively similar amount glottal variants, except for middle class females (16%); in the old group, working class males glottal(ise) the most reaching a rate of 51%. Furthermore, the use of word-medial /t/ glottaling appears to be aged-graded among working class males.

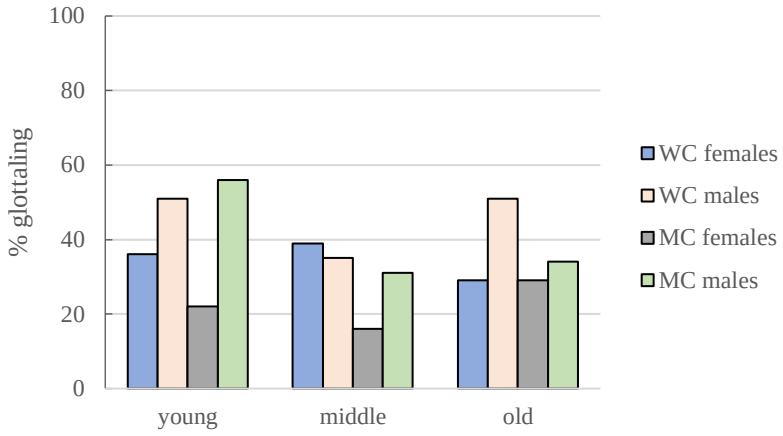


Figure 6.5.1 Overall results for word-medial /t/ glottaling.

In the literature, word-final /t/ and word-medial /t/ are typically investigated separately as two different phonological contexts where the rule application is not identical. The preceding phonetic segment of word-medial or word-internal /t/ is typically restricted to vowels (e.g. intervocalically). To account for word-medial /t/, I initially distinguished four syllabic contexts aiming at a more detailed descriptive analysis:

(a) /t/ in word-medial syllable final (e.g. *nightmare*, before a morpheme boundary)[20],

(b) intervocalic position (e.g. *better*)

(c) syllabic /l/ contexts (e.g. *bottle*), and

(d) /t/ at the onset position (e.g. *seventeen, sometimes*[21]).

Tokens with syllabic /n/ (e.g. *button*) were initially included in the multivariate analysis, yet /t/ was categorically retained. While the intervocalic position includes all the unstressed contexts, the onset position includes the stressed ones (e.g. the *-ee/-oo* tokens, such as *tattoo*). The latter, as previously outlined, was commonly found to be

[20] This study follows Tollfree (1999) in treating /t/ in word-medial syllable final contexts in tokens like *nightmare*.

[21] Word-medial foot initial tokens (e.g. *canteen*) were all preceded by a consonant, while word-medial syllable final positions (e.g. *Gatwick*) were mostly followed by a consonant, except for 6 occurrences out of 163, which are followed by a vowel. The latter result from the regular past *-ed* affixation (e.g. *adopted, reported).*

the most constraining environment, yet several studies have demonstrated that, in some British dialects[22], /t/-glottaling has started spreading through the prosodic hierarchy (Harris & Kaye 1990; Baranowski & Turton 2015; Smith & Holmes-Elliott 2017). However, due to the low number of tokens in certain factor groups[23], the four syllabic contexts were collapsed into one more general category: word-medial /t/ - in line with previous research (e.g. Schleef 2013; Hall-Lew et al. 2019). However, when the data are divided by syllable context the hierarchical distribution of /t/ glottaling is the following:

morpheme boundary > syllabic /l/ > intervocalic > onset.

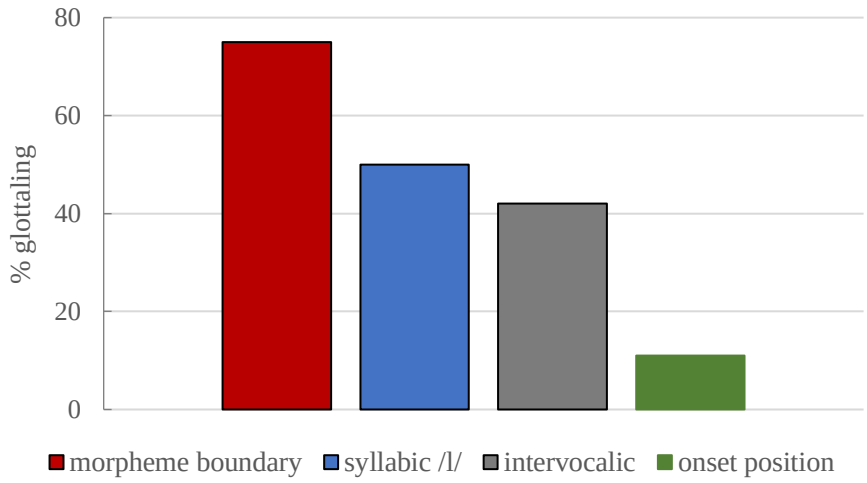


Figure 6.5.2 Rates of (t) glottaling by syllable type.

Where comparison is possible, the above hierarchy seems to resemble Buckie for the high use of non-standard variants in pre-syllabic lateral /l/ position[24], yet this context is strongly disfavouring in other varieties (see Stuart-Smith 1999) and it is considered as the second least favouring environment in Hughes et. al's (2012) ranking, illustrated

[22] So far, there is evidence of /t/-glottaling at the onset position in Manchester and Buckie.
[23] In Buckie, syllabic context and following environment were combined "within one elaborated category" as the following environments result in: pause, vowel and syllabic consonant (Smith & Holmes-Elliott, 2017: 12).
[24] In Buckie, /t/ glottaling rates in pre-syllabic lateral position go beyond 75 per cent.

in Chapter 5. The intervocalic position follows with a modest difference, employing lower rates of application as previous descriptions of other dialects have shown. However, the argument that the ongoing spread is most noticeable intervocalically, seems to also hold for East Anglia. In Derby, for instance, only younger speakers produced 22% of glottals, while older ones produced only four medial glottal tokens (Docherty & Foulkes, 1999).

On the other hand, the onset environment exhibits a marginal use of [ʔ] in this context (for a robust use of [ʔ] in onset positions see Smith & Holmes-Elliott 2017). This finding suggests that, despite the low probability of application, in East Anglia, /t/ is not categorically retained at the onset, and that glottaling might have started the next stage of this process, that is diffusion in stressed environments. In a similar vein, Bermúdez-Otero (2010) argues that a phonological process, over time, may spread through the prosodic hierarchy, affecting inclusive environments. With reference to glottalization in word-initial syllable onset positions, Docherty et al. (1997: 290) argue that:

> "It is in general unwise to make a negative claim to the effect that glottalisation does NOT occur in this position, even if the occurrences are rare… In the environments reviewed above which are said to block glottalisation, we can state more accurately that the probability of glottalisation occurring is lower than in, say, presyllabic-lateral positions."[25]

From a statistical standpoint, the best model achieved in the multivariate analysis shows that word-medial /t/ is significantly constrained by the preceding phonetic segment, lexical-frequency, following phonetic segment, sex, age and stress[26].

[25] This argument also holds for the application of glottaling / glottalisation in word-final /t/ after preceding fricatives. As noted earlier, the phonological process is marked as a highly disfavouring factor, but in this context glottal(ised) variants are not categorically blocked.

[26] For the word-medial sample, style was not included as a predictor in the regression analysis as /t/ was categorically glottal(ised) in informal speech, whilst in the more formal style (i.e. reading passages) it was categorically realised as a plain /t/. Hence, this constraint had to be excluded from the multivariate analysis since the only remaining factor group was the word lists, with a rate of 10% glottaling.

Preceding environment. In the word-medial sample, the greatest effect is contributed by the preceding phonetic segment, similarly to word-final /t/. The most favouring factors are vowels, with front ones (e.g. *natter*) leading the ranking (.80). Central and back vowels (e.g. s*enator*; *cutter*) favour at .555, slightly ahead of the .50 threshold and not very far from being a neutral context. Conversely, preceding nasals (e.g. *canteen*), stops and fricatives (e.g. *laptop*; *westfield*) disfavour at .441 and .203, respectively. Comparable findings were found in London and Edinburgh where among teenagers the glottal stop was more likely to be produced after a preceding vowel, than after a preceding nasal or liquids. In the East Anglian database, preceding laterals are excluded from analysis owing to the low number of tokens in this category (n = 4).

Application value = glottaling; overall proportion = 0.361 R^2 = 0.530; log likelihood = -911.106; *N* = 1872				
Constraints	**Logodds**	**FW**	**%**	**Tokens**
Preceding Env.				
p<.001				
front vowels	1.386	0.80	50	919
central & back vowels	0.222	0.555	32	541
nasals	-0.238	0.441	12	263
stops & fricatives	-1.37	0.203	7	149
Word-frequency				
p<.001				
high-frequency	0.689	0.666	46	1289
low-frequency	-0.689	0.334	14	583
Following Env.				
p<.001				
stops & fricatives	1.502	0.818	75	77
nasals	0.274	0.568	68	41
liquids	-0.256	0.436	54	167
central & back vowels	-0.656	0.342	35	478
front vowels	-0.864	0.297	30	1109
Sex				
p<.01				
males	0.428	0.605	44	916
females	-0.428	0.395	29	956
Age				
p<.01				
young	0.691	0.666	43	574
middle-aged	-0.107	0.473	32	661
old	-0.584	0.358	33	637
Syllable stress				
p<.01				
non-primary	0.174	0.543	37	810
primary	-0.174	0.457	35	1062

Table 6.5.1 Multivariate analysis of (t) glottaling in the whole WM dataset.

From a theoretical viewpoint, the sonority hierarchy appears to be an explanatory factor in this preceding word-medial context, where highly sonorous preceding segments induce /t/ to glottal(ise): front vowels > central and back vowels > nasals > stops and fricatives. A closer inspection revealed that the trend of males and females goes in the

same direction, yet males are ahead of females especially when /t/ follows a front vowel, but not significantly.

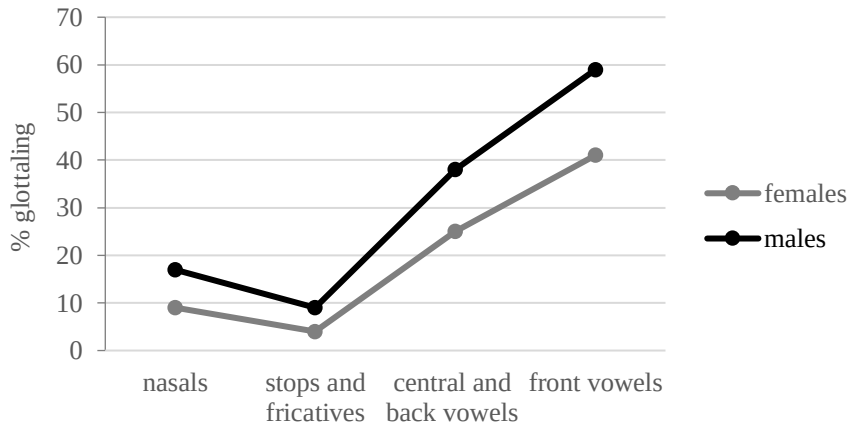


Figure 6.5.3 Rates of WM /t/ glottaling by preceding environment and sex, $p > .05$.

With respect to age, figure 6.5.4 shows that old speakers produce slightly more glottaling in pre-nasal, pre-stop and pre-fricative environments. By way of contrast, middle-aged speakers near-categorically do not adopt the glottal stop when /t/ follows stops and fricatives; additionally, they are also behind the two age groups after preceding front vowels. Whereas young speakers are ahead in the central and back vowel environment, the rates of glottaling after a preceding front vowel are slightly higher among old speakers. In the same phonetic context, young and middle-aged show a rate of application higher than 30% (for middle-aged) and lower than 45% (for young speakers).

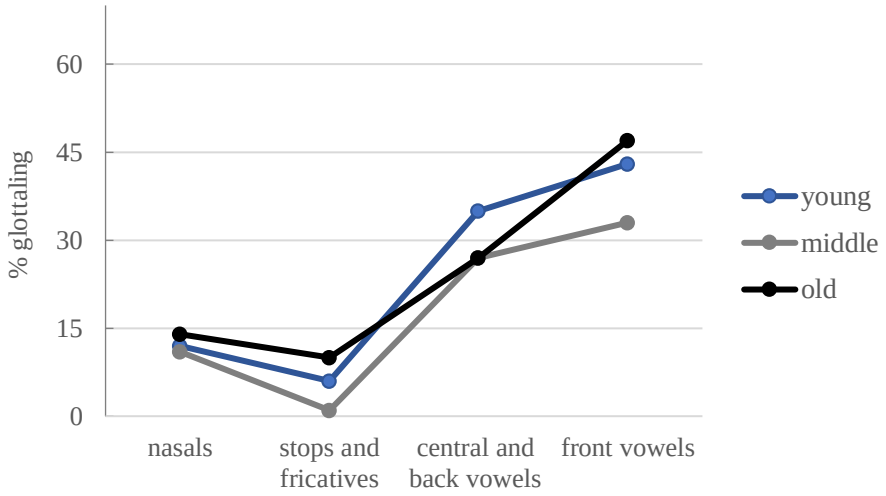


Figure 6.5.4 Rates of WM /t/ glottaling by preceding environment and age, $p < .01$.

Lexical frequency. The strong effect of lexical token frequency has long been argued to be an influential factor in previous studies of lenition, such as the (t,d) variable - in some English varieties (Bybee 2000b). By way of contrast, there seems to be a limited number of studies which took this predictor into account to explore specifically /t/ glottaling. Schleef (2013) found lexical frequency to be significant word-medially in both London and Edinburgh, whereas its effect on word-final /t/ emerged only in London. Barrera (2015) found a word-frequency effect in her RP sample in both phonological contexts.

From a qualitative viewpoint, Baranowski et al. (2016) argue that high-frequency words exhibit high rates of (t) glottaling in Manchester, yet the rate of change over time is the same for high and low frequency words. Hence, there is no evidence that high frequency words change faster. Their focus is rooted on how /t/ glottaling exhibits lexical frequency effects, and whether or not the magnitude of this effect increases as the change progresses. Their findings support modular theories of phonological representation – different from episodic models, which argue in favour of high frequency words changing faster.

Quantitatively, results from East Anglia confirm that the probability of /t/-glottalling, in apparent time, is higher in high-frequency words, whose magnitude is twice the size of low-frequency tokens.

Following environment. The third most relevant predictor to account for the variance of (t) is the following phonetic segment, with stops and fricatives (e.g. *netball*; *outside*), and nasals (e.g. *nightmare*) favouring glottal(ised) variants at .818 and .568, respectively. Liquids (e.g. *settle*) and following vowel environments (e.g. *fainted*[27]*; obscenity)* are marked as disfavouring factors.[28] Findings from London (Schleef, 2013) reveal that, word-medially, obstruents (.89), nasals and liquids (.61) favour the glottal replacement, while following vowels strongly disfavour it (.07). The difference between East Anglia and London in the behaviour of following liquids remains unclear[29]. These results are at odds with Schleef's (2013) findings in Edinburgh, where the following environment does not affect word-medial /t/-glottaling in a statistically significant way (Schleef, 2013).

In Glasgow, categorical absence of glottal stop occurs word-medially in Class 1 adults. (Stuart-Smith, 1999). The glottaling process is attested in word-internal non-foot initial onset context (e.g. *printer*, *botany*, *Saturday)* (Tollfree, 1999) even in East Anglia, yet there seems to be no relevant influence of the following vowel type. The fact that the following environment of word-final and word-medial /t/ vary in the

[27] In Norwich English, final *-ed* can be realised as /-ət/, as in *hundred* [hʌndɪəʔ], where word-final glottal replacement can occur (Trudgill, 1974). Similarly, /t/ in *fainted* is followed by schwa, and it is above reported as an example of pre-central vowel.

[28] Note that glide tokens were excluded from the analysis owing to the low number of tokens (n = 9). In 7 out of 9 tokens, /t/ was preceded by the labio-velar glide /w/ as in *Gatwick, network, between* etc.; while /t/, only in two cases, was followed by the palatal glide /j/ where /t/ was retained, as in *fortune*. In many varieties of English such cases, in the absence of yod-dropping, are typically palatalised [tʃ]. For a more detailed account on /j/, in East Anglia, see Trudgill (1974) who reports a retained use of /j/ in *use, ewe, value* (but not *curlew*).

[29] This might be due to the fact that liquids are collapsed with nasals in Schleef's study, yet it is inexplicit whether these two factors were combined because they were strongly marked as disfavouring factors or due to the low number of tokens in one of those categories.

ranking to a small degree suggests that, at least in East Anglia, /t/ glottaling is under the control of similar phonetic constraints which move in the same direction. Indeed, the rankings below show that /t/-glottaling is favoured pre-consonantally, but not pre-vocalically.

(7) word-final /t/

nasals > liquids > stops > fricatives > central vowels > pause > front vowels > back vowels

(8) word-medial /t/

stops + fricatives > nasals > /l/ > central and back vowels > front vowels

Following consonants, which exhibit a different order ranking, diverge only in the behaviour of /l/ word-medially. Following liquids favour /t/ glottaling in word-final position, yet pre-syllabic lateral /l/ disfavours it in word-medial position.

Let us turn attention to the interaction between the social and the linguistic dimensions. Crosstabulations between the following environment and sex revealed that women tend to glottalise more than men when /t/ is followed by nasals, stops and fricatives; while before liquids and vowels men use the non-standard variants more frequently than women. This finding is not surprising as it is in line with the literature: word-medial pre-consonantal has been regarded as a non-stigmatised context (Wells 1997; Tollfree 1999; Altendorf 2003; Hughes et al. 2005), hence glottals are preferred by women; following syllabic /l/ as well as vowels have been viewed as "stigmatised" environments, and thus males are ahead in the use of glottal(ised) variants.

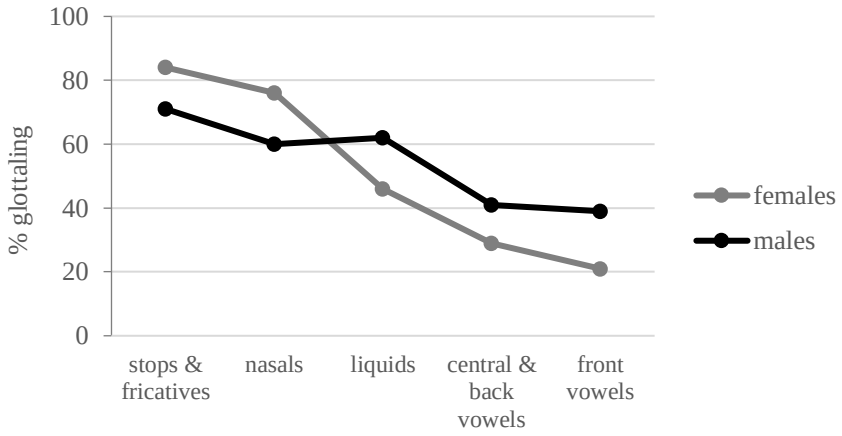


Figure 6.5.5 Rates of /t/-glottaling by following environment and sex, p <.01.

Crosstabs by age and following phonetic segment (see figure 6.5.6 revealed that young speakers are ahead of the middle and old ones, particularly before nasals and front vowels. The latter is not a surprising finding as glottal(ised) variants word-medially - precisely in intervocalic context – were found to be preferred by the youngsters[30] (see Milroy et al., 1994). Older speakers show a strong linear effect, with a decreasing of the non-standard feature as sonority increases. Interestingly, middle-aged speakers once again fall behind, but this time in different phonetic contexts: before nasals, central and back vowels, and slightly before liquids.

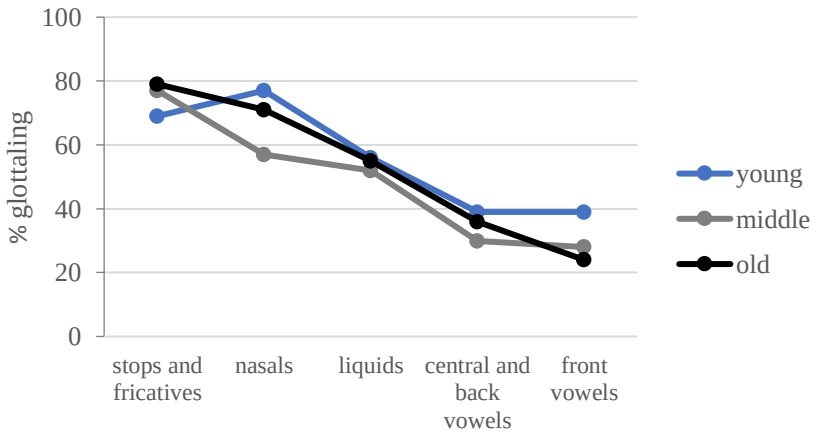


Figure 6.5.6 Rates of WM /t/-glottaling by following environment and age, p <.001.

[30] The tendency of using the glottal stop was particularly associated with young middle-class females (Milroy et al., 1994).

Age and *sex*. The most marked difference between word-final and word-medial /t/ is linked to the social dimension which surfaces only word-medially. Sex exhibits a higher proportion of variation compared to the age of speakers. The fact that class is not listed among significant predictors in the logistic regression analysis should not be surprising. Indeed, it has been argued that in terms of influence on linguistic variability, gender should be considered prior to social class, as the role played by gender is greater than social class influences in many speech communities (e.g. Milroy et al., 1994).

In East Anglia, males produce more glottal stops than females, in line with the assumption that "this variant is a male working-class norm" (Docherty et. al, 1997: 305). Previous studies in Norwich (Trudgill, 1974), in Edinburgh (Romaine, 1975), in London (Hudson & Holloway, 1977), Glasgow (Stuart-Smith, 1999) and many others show that males were leading the change[31] (see Collins and Mees (1999) for opposite results). Figure 6.5.7 displays a young male preference for the glottals, followed by older males and finally by the middle-aged counterpart. Females, overall, produce lower rates of these variants with middle-aged being slightly ahead of younger speakers, while older speakers fall behind. Statistical details report the influence of young speakers, whose probability weight is .66, far exceeds that of middle and older speakers who disfavour /t/-glottaling at .47 and .36, respectively. This means that the clear gender-related preference in the youngsters diminishes in older speakers and neutralises in the middle age group.

[31] Docherty et al. (1997) found a female preference in the use of glottals in Tyneside, and argue that the traditional and more common finding (males > females) may be due to the fact that many studies do not distinguish glottal stops from reinforced stops.

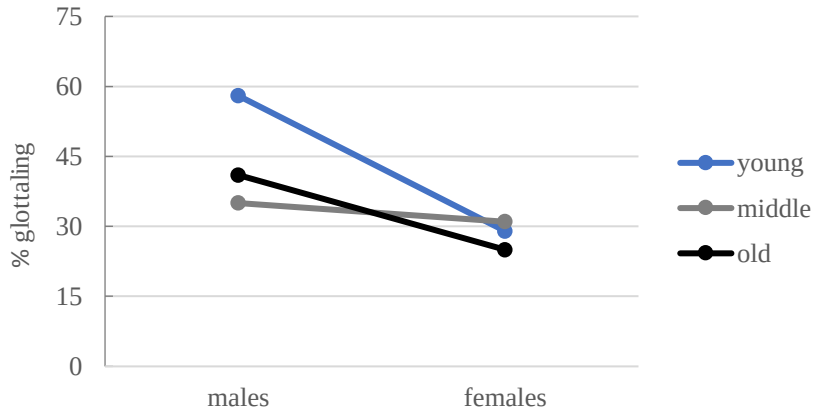


Figure 6.5.7 Rates of WM /t/- glottaling by sex and age.

Stress. The last predictor which surfaced in the mixed-effects analysis is stress. As outlined, in chapter 2, stress was coded as a binary factor: primary vs. non-primary – depending whether /t/ occurred in a stressed (e.g. *haters*) or non-stressed syllable (e.g. *favourite*).

Variation in realisation of /t/ has been previously accounted for with reference to stress (e.g. Holmes 1995; Tollfree 1999). Holmes (1995) reports that main stress triggers the use of glottals more than reduced stress, whereas Tollfree (1999) claims that "T-glottalisation is optional where the stress on the syllable following /t/ is less than that borne by the preceding syllable, i.e. in non-foot-initial onset position" as in *guilty* (Tollfree 1999: 172).

The stress pattern found in East Anglia, for word-medial /t/, suggests that unstressed syllables containing /t/ favour glottal(ised) variants, whereas syllables with primary stress disfavour glottals. This predictor, however, is the least statistically powerful and the probability difference between primary and non-primary stress is quite small: the former exhibits a 37 per cent of glottals, whereas the latter 35 per cent. So far, we have discussed the results of the logistic regression analysis exploring closer those predictors which proved the null-hypothesis false. Let us now inspect the glottal

variation at an individual level to see whether each speaker is participating in the change. The individual variation was controlled for by including speaker as a random effect in the mixed-effects model. Figure 6.3.8 displayed a good clustering of young individuals with respect to word-final /t/; we would expect the same result word-medially given the leading position of young speakers. However, figure 6.5.8 exhibits more dispersion in the young and middle age groups than in the old counterpart, where individuals tend to be clustered. A closer examination reveals that the low rates of glottals among young speakers are due to a relevant number of tokens where /t/ occurs at the onset position, such as *nineteen*. When these words are excluded from the dataset glottaling rates increase in the young generation.

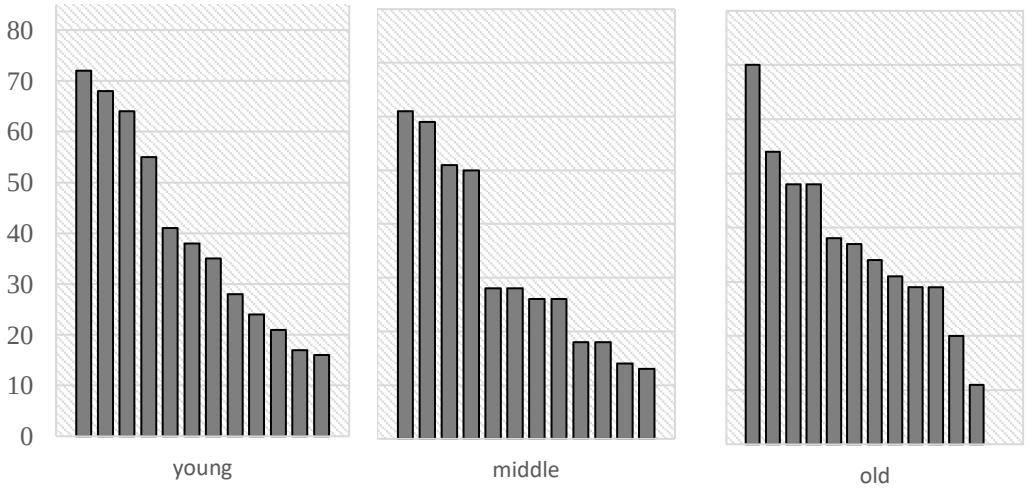


Figure 6.5.8 Percentages of WM /t/ by individual speaker.

Although the factors that appear to constrain word-medial and word-final /t/ are markedly divergent, the effect size of the preceding and following phonetic segment is remarkably similar. The statistical effect of social factors, instead, emerged only word-medially with age and sex conditioning (t).

6.5.1 Non-significant factors – word-medial /t/

Social class, the third social factor included in the model, is marked as a non-significant predictor along with location. Working-class speakers adopt glottals more than their middle-class counterpart, but not significantly. Similarly, no striking difference was detected for the three locations. One-level analysis shows that Colchester and Ipswich favour /t/-glottaling, while Norwich disfavours it, but not significantly. Indeed, the tables below illustrate the similarity in the glottaling rates among the three localities. Although location is not a statistically relevant predictor, it is worth exploring in detail how /t/ behaves word-medially in Colchester, Ipswich and Norwich to inspect the internal diffusion of this phenomenon across geographical areas.

6.6 Treating Colchester, Ipswich and Norwich separately.

Overall, word-medial /t/ in East Anglia appears to be phonologically and socially conditioned. By exploring closer the three localities, we will see whether the same factors surface uniformly.

6.6.1 Results from Colchester – word-medial /t/

Table 6.6.1 below shows results of word-medial /t/ according to the statistically prominent constraints. The most favouring factors, in order of significance, are the preceding phonetic segment, the following environment, lexical frequency and sex.

Preceding environment. The influence of the preceding phonetic segment does not seem to resemble the overall East Anglian pattern. In Colchester, front vowels favour at .766, stops and fricatives are not very far from being a neutral context favouring /t/-glottaling at .507, whereas central and back vowels along with nasals disfavour at .452 and .265, respectively.

(1) *East Anglian pattern*

front vowels > central and back vowels > nasals > stops and fricatives

(2) *Colchester pattern*

front vowels > stops and fricatives > central and back vowels > nasals.

Clearly, the Colchester pattern is not in line with the sonority hierarchy of the overall East Anglian pattern given the high place of stops and fricatives in the ranking, and given the low position of nasals, which is the least favouring segment for /t/-glottaling to occur.

Application value = glottaling; overall proportion = 0.388 R^2 = 0.559; log likelihood = -296.004; *N* = 749				
Constraints	**logodds**	**FW**	**%**	**Tokens**
Preceding environment p<.001				
front vowels	1.184	0.766	53	315
stops & fricatives	0.028	0.507	21	34
central & back vowels	-0.194	0.452	28	34
nasals	-1.018	0.265	8	70
Following environment p<.001				
stops & fricatives	2.275	0.907	84	25
nasals & liquids	-0.28	0.43	60	70
front vowels	-0.94	0.281	34	331
central & back vowels	-1.055	0.258	32	152
Lexical frequency p<.001				
high frequency	0.755	0.68	48	424
low frequency	-0.755	0.32	14	154
Sex p<.05				
males	0.602	0.646	50	283
females	-0.602	0.354	28	295

Table 6.6.1 Multivariate analysis of WM /t/ in Colchester.

Following environment. Following nasals typically highly promote glottals in words such as *witness* yet, in Colchester, they favour production of the coronal stop. This

might be a result of the re-coding of nasals, grouped together with liquids here, owing to insufficient number of tokens in the nasal category to carry out an accurate statistical analysis. Following vowels, in agreement with the overall pattern, disfavour /t/-glottaling. The exchange of place between front vowels with central and back ones is not relevant since they all inhibit glottals. The only favouring predictors for the following environment are stops and fricatives, showing a probability of .907. Typical findings, indeed, show that following obstruents as in *Whitby, Watford* enhance the use of glottal variants.

(3) *East Anglian pattern*
stops and fricatives > nasals > liquids > central and back vowels > front vowels

(4) *Colchester pattern*
stops and fricatives > nasals and liquids > front vowels > central and back vowels.

Lexical frequency. The third most favouring predictor is lexical frequency, with high frequency tokens being subject to glottals more than low frequency ones.

Sex. The least favouring constraint is sex - the only social factor which reached statistical significance in Colchester, with males being ahead of females in producing glottal(ised) variants, exhibiting a probability of .646.

6.6.2 Results from Ipswich – word-medial /t/

In Ipswich, the preceding environment, lexical frequency, following context, stress and age have a significant influence on the response. Table 6.6.2 shows that factor groups are nearly identical to the East Anglian pattern.

Preceding environment. The preceding phonetic segment reaffirms its robust conditioning in Ipswich, with preceding vowels promoting the use of glottals, while preceding consonants favour /t/ retention particularly stops and fricatives, which

strongly disfavour /t/ glottaling. This finding counteracts the Colchester pattern where obstruents are the second most preferred environment for glottals to occur.

(5) *East Anglian pattern*
front vowels > central and back vowels > nasals > stops and fricatives

(6) *Ipswich pattern*
front vowels > central and back vowels > nasals > stops and fricatives.

Application value = glottaling; overall proportion = 0.39 R^2 = 0.748; log likelihood = -283.850; *N* = 694				
Constraints	**logodds**	**FW**	**%**	**Tokens**
Preceding environment **p<.001**				
Front	2.053	0.886	56	314
central & back vowels	0.493	0.621	39	196
nasals	0.346	0.586	15	114
stops & fricatives	-2.893	0.053	2	70
Lexical frequency **p<.001**				
high-frequency	0.864	0.696	54	428
low-frequency	-0.864	0.304	15	266
Following environment **p<.001**				
stops & fricatives	1.956	0.876	92	24
nasals & liquids	-0.401	0.401	63	63
central & back vowels	-0.407	0.4	44	173
front vowels	-1.149	0.241	30	434
Age **p<.001**				
young	1.851	0.864	56	195
middle	-0.885	0.292	27	274
old	-0.966	0.276	39	225
Stress **p<.001**				
non-primary	0.48	0.618	44	297
primary	-0.48	0.382	35	397

Table 6.6.2 Multivariate analysis of WM /t/ in Ipswich.

Lexical frequency. The second most favouring predictor is word frequency, with high frequency tokens triggering the use of glottals more than low frequency ones.

Following environment. Results from the following phonetic segment are uniform with the overall pattern despite a marginal difference, as shown below:

(7) *East Anglian pattern*
stops and fricatives > nasals > /l/ > central and back vowels > front vowels

(8) *Ipswich pattern*
Stops and fricatives > nasals and liquids[32] > central and back vowels > front vowels.

Age. The penultimate significant predictor in this analysis is age - the only social factor that influences word-medial /t/ in Ipswich - with younger speakers favouring [ʔ], while middle and older speakers disfavour it.

Stress. Unlike the findings from Colchester, stress surfaced in the Ipswich regression analysis yielding the ranking: non-primary > primary.

6.6.3 Results from Norwich – word-medial /t/

By contrast, syllable stress, in Norwich is not marked as a significant factor; this suggests that glottals occur word-medially regardless of whether /t/ belongs to a stressed or unstressed syllable. The significant factors that emerged in this multivariate analysis include the preceding phonetic segment, lexical frequency and the following phonetic segment, as illustrated in table 6.6.3.

Preceding environment. When stops and fricatives are included in the analysis, they are the only predictors to be marked as strongly disfavouring factors, as shown in the table below. However, when obstruents are removed from the analysis front vowels favour at .67, whilst central and back vowels together with nasals disfavour at .48 and

[32] Similar to Colchester, nasals and liquids had to be collapsed even in Ipswich.

.35, respectively. In this case, the restriction of glottals to occur before a preceding schwa (Trudgill, 1974) would still hold for Norwich word-medially.

(9) *East Anglian pattern*
front vowels > central and back vowels > nasals[33] > stops and fricatives

(10) *Norwich pattern*
front vowels > central and back vowels > nasals > stops and fricatives.

Application value = glottaling; overall pattern = 0.302 R^2 = 0.413; log likelihood = -300.502; *N* = 600				
Constraints	**logodds**	**FW**	**%**	**Tokens**
Preceding Env. **p<.001**				
front vowels	1.351	0.794	40	290
central & back vowels	0.573	0.64	28	186
nasals	0.079	0.52	12	79
stops & fricatives	-2.003	0.119	2	45
Lexical frequency **p<.001**				
high frequency	0.529	0.629	33	437
low frequency	-0.529	0.371	11	163
Following Env. **p<.01**				
stops & fricatives	0.808	0.692	53	28
nasals & liquids	0.247	0.562	49	75
central and back	-0.504	0.377	27	123
front vowels	-0.552	0.365	26	344

Table 6.6.3 Multivariate analysis of WM /t/ in Norwich.

Lexical frequency. In line with the literature and with the trend which has been discussed in this chapter, high frequency tokens show a probability of .629, which is nearly double the size of that of low frequency words (.371).

[33] In the overall pattern, nasals were marked as a disfavouring factor.

Following environment. Similar to word-final /t/, this phonological context rejects the null hypothesis at p <.01, whereas in both Colchester and Ipswich levels of significant are smaller (p<.001). This would suggest that (a) (t) glottaling is completing the change in this environment in Norwich; (b) Norwich is ahead of Colchester and Ipswich in the rule application word-medially as also suggested by the lack of social effect.

When zooming into this phonological constraint both nasals and the lateral /l/ promote glottals in Norwich, despite being grouped together, resembling word-medial findings from London (Schleef, 2013).[34] Following vowels favour the retention of the coronal stop.

(11) *East Anglian pattern*
stops and fricatives > nasals > /l/ > central and back vowels > front vowels

(12) *Ipswich pattern*
stops and fricatives > nasals and /l/ > central and back vowels > front vowels

6.7 Summary

This Chapter has examined word-final and word-medial /t/ in East Anglia.

The results suggest that word-final /t/ has completed its social change and is spreading in phonological space (e.g. after a preceding schwa where the use of glottals was found to be previously blocked, at least in Norwich). It appears that glottal variants in this phonetic context have nearly completed the change in East Anglia and have also spread to more formal varieties, such as RP. Word-medial /t/ is both phonetically and socially conditioned with young males being ahead of females. However, in Norwich no social

[34] When we looked at the overall results (the three localities together) nasals and /l/ were treated separately, as the number of tokens in the nasal category was above the statistical threshold of 30. However, when the dataset was divided according to the three urban areas, nasals and /l/ had to be grouped together.

significance was reported, and the restriction found by Trudgill (1974) still holds before a following schwa. The latter also holds for Colchester and Ipswich.

Chapter 4 and chapter 6 have investigated two phonological variables: (t,d) in word-final consonant clusters, and (t) in word-final and word-medial position. (t,d) and word-final (t) intersect in word-final consonant clusters, yet their intersection appears to have been ignored so far. Wells (1999a, in answer to question number 12 in the list of 'Frequently Asked Questions'), remarks that "no-one can know what will happen in the future: if the glottal stop is indeed a stage on the route to disappearance [elision] […]." In the attempt to provide an answer to the above claim – twenty years later – the phonological co-variation of (t) deletion and (t) glottaling in word-final consonant clusters will be examined in the chapter to follow.

Chapter 7 - INTERSECTION BETWEEN (t) DELETION AND (t) GLOTTALING IN WORD-FINAL CONSONANT CLUSTERS: RESULTS AND DISCUSSION

So far, we have discussed the co-variation of phonological and sociological variables - one of the main goals of sociolinguistics research. In this Chapter, the focal point will be the co-variation of the two linguistic variables previously examined: (t) deletion and (t) glottaling, which intersect in word-final consonant clusters. To start with, I will provide some terminological remarks, followed by a categorisation of the two variables, and a brief review of the concept of co-variation between linguistic variables; I will then turn to the subject of lenition, and phonological rule ordering following with an outline of analytical procedure; finally, I will present and discuss the overall results (three localities together) of this intersection analysis.

7.1 Terminological Remarks

Intersection between (t) deletion and (t) glottaling means that in words like *can't, kept,* the non-standard variants of the /t/ may be elided (e.g. [k*a*ːn]) or may have a glottal gesture (e.g. [k*a*ːnʔ])[1]. To avoid any kind of terminological confusion between (t) glottaling in word-final context (e.g. *what, that*) and (t) glottaling in word-final consonant cluster (e.g. *kept, event*), the former will be referred to as word-final /t/ glottaling[2], whilst the latter will be called (t) glottaling in the C(C)t environment.

This question does not concern the (t,d) variable, in which both /t/ and /d/ occur in C(C)t and C(C)d positions. This analysis, instead, set out to examine only patterns of

[1] The terms *intersection* and *covariation* will be used interchangeably in this chapter.
[2] See Chapter 5 for further details on the use of this term throughout this survey.

variation between (t) deletion and (t) glottaling in the C(C)t environment, even though the voiced alveolar /d/ can be subject to glottal realisations.

Temple (2014) provides evidence of a small number of tokens where the /d/ undergoes glottalisation in the York (t,d) dataset, as in *second-hand shops* [sɛʔn̩ˈhant͡ʔʃɒps], where the first voiced alveolar is deleted, whilst the second is devoiced and glottalised. Glottal realisation of /d/ is common in other English dialects, such as AAVE (e.g Fasold, 1972) and Norwich English. With respect to Norwich English, Trudgill (1974) demonstrates that final *-ed* can be realised as /-ət/; thus, the voiceless alveolar is likely to be replaced by the glottal stop as in *hundred* [hʌndɪəʔ]. There seems not to be reason to consider final (-d) a sociolinguistic variable in Norwich.

7.2 Status of the two phonological variables in East Anglia

Let us briefly return to the sociolinguistic categorisation of these two phonological features. We have seen that the status of (t,d), in East Anglia, is that of a stable variable; whereas the profile of (t) is explained as follows: /t/ glottaling in word-final position is a change in progress which has reached social completion in many parts of the UK (Baranowski & Turton 2015), including East Anglia where glottal variants are now spreading in phonological space; word-medial /t/ glottaling, by contrast, is both phonetically and socially conditioned.

These two linguistic variables are usually analysed as parallel models: non-standard /t,d/ deletion vs. /t/ retention, or non-standard /t/ glottaling vs. coronal forms of /t/. As indicated earlier, it is common practice to code glottal variants along with apical stops, when examining (t,d) deletion, as the glottal gesture is treated as a presence, as opposed to deletion – the complete loss of the segment. Even though these

two variables intersect in British English, no systematic investigation has been carried out on their intersection, as Amos et al. (2018) recently observed.

7.2.1 Research questions for intersection

Given that British English allows for more than two alternations in word-final consonant cluster, as in */kept/* which can be realised as [kɛpt], [kɛʔ], [kɛpʔ], [kɛp]; and since the results from East Anglia display a slight visible variability of /t/ glottaling in environments previously stigmatized (e.g. after preceding stops and fricatives[3]), the two non-standard features - (t) deletion and (t) glottaling – will be explored in a more restricted linguistic environment, that is in word-final consonant clusters (e.g. *silent, fault, kept*), as the elision of apical stops (i.e. (t,d) absence) typically occurs in this phonological context. This analysis will be examined by means of a mixed-effects binary regression analysis to observe patterns of variation (see section 7.7). The research questions which arise in this regard are summarised as follows:

- Does intersection change the frequency of deletion?
    - of glottal forms?
- How should they be properly counted?

7.3 Covariation between linguistic variables

Most of sociolinguistic research deals with covariation between linguistic variables and social factors. Trudgill (1974: 64) states that "a phonological variable can be defined as a phonological unit which is involved in co-variation with sociological parameters or with other linguistic variables." The traditional variationist research which focused

[3] See Tollfree (1999).

on linguistic/social covariation has been later expanded including covariation of explanatory linguistic factors as prime goal (Wolfram 1993; Patrick 1999). In this Chapter, we will mainly focus on exploring the covariation of (t) deletion and (t) glottaling in the C(C)t linguistic context.

Covariation can be also explored in terms of spatiality, with isoglosses mirroring dialect boundaries (Labov et al. 2006); in terms of style shifting of multiple variables (Rickford & McNair-Knox, 1994), in terms of interspeaker covariation (Tamminga, 2019), in which speakers are compared across a range of variable features. Comparison between speakers across phonological variables has been also carried out in British creole (Patrick, 2004). Some linguists have looked at the intersection between variables in terms of feeding and bleeding, such as Anttila (2002b).

In a volume devoted to the theme of covariation between linguistic variables, Guy and Hinskens (2016: 5) state that "the question of whether and how in a given speech community (or in a coherent sector of a speech community) multiple variable phenomena are interrelated has received little attention until recently." Several studies have addressed this matter. Horvath & Sankoff (1987) investigated 20 vocalic variants in Sydney English, showing how the distribution of speakers is similar or different in linguistic space, rather than examining the distribution of linguistic variables in the social dimension.

Patrick (1999) observed the covariation between phonological and morphological features by examining (t,d) deletion at the intersection with past marking in Jamaican Creole. His results from the creole continuum show that the regular affixation of /-t,-d/ as a past tense marker is not compulsory, that is some sentences "are systematically ambiguous as to time reference" (Patrick, 1999: 169).

This explains the high /t,d/ deletion rate in regular past tense verbs which is due to morphological absence (see Chapter 3 for further details).

Guy (2013) explored four binary variables among working class speakers of Popular Brazilian Portuguese. Some of the variables in his work were found to be in covariation, even though some speakers showed an idiosyncratic behaviour. Guy (2013) also suggests distinguishing between socially motivated covariation from interactions driven by structural linguistic correlations among variables, as even if covariation may be facilitated by structural relationships, sociolinguistic coherence surfaces separately.

In characterising the expectation of covariation, Guy and Hinskens (2016: 2) argue that "the orderly variables that define the community should collectively behave in parallel (i.e. cohere), that is, variants (or rates of use of variants) that index a given style, status, or a social characteristic should co-occur." Coherence, in this context, regards to what degree multiple co-existing linguistic variables show an analogous distribution. This parallel behaviour springs from the concept of speech communities being sociolinguistically coherent; that is, speakers who belong to higher classes would adopt all linguistic features associated with their class status.

However, this issue is a prime theoretical debate in contemporary sociolinguistics, as Guy and Hinskens' (2016) argument appears to be at odds with the claim that speakers actively, idiosyncratically adopt the social signalling of variants in their communities of practice in order to construct identities, stances, and styles – a view known as *bricolage* after Eckert (2008). The issue of at what point such individual initiatives become community patterns, however, will not be addressed here as it is beyond the purpose of this research.

One of the questions raised by Guy and Hinskens (2016: 4) is: "Which features correlate and which do not? To what extent, and in what ways, do the characteristic variables associated with a dialect or speech community co-vary? Which co-varying linguistic features / domains are involved in change in progress and which tend to be constant?" With respect to the social dimension the question asks: "Are there socially identifiable leaders of change who tend to use all the innovative variants together, or are different innovations subject to differentiated social interpretations and individuated patterns of usage?"

As regards Philadelphia vowel changes[4], Tamminga (2019) suggests that interspeaker co-variation springs from a shared social motivation.

The above considerations appear not to be equally applicable to the present analysis, as studies which have addressed the issue of covariation so far have investigated multiple variables to observe a potential coherence within the speech community. In the present Chapter, conversely, we will be dealing with covariation between two non-standard features. The relationship between (t) deletion and (t) glottaling in the C(C)t environment, here, will be mainly explored through the lens of lenition, and through the rule ordering of feeding and bleeding, rather than that of coherence.[5]

7.4 A brief account of lenition

The terms 'lenition' and 'weakening', as outlined in Chapter 5, are interchangeably used in phonology (e.g. Carr 1993, Hock and Joseph, 1996) and imply a notion of

[4] The vowels investigated include the following lexical sets: FACE, PRICE, TOOTH, DOWN, GOAT, THOUGHT.
[5] Guy & and Hinskens (2016) also address the matter of covariation and coherence among different linguistic systems, raising questions related to language contact.

consonantal strength[6] (Ashby & Maidment, 2005). According to Lass and Anderson (1975: 151), "[…] strength is equated with resistance to airflow through the vocal tract, and weakness with lack of such resistance." Two current definitions of this process, reviewed by Honeybone (2008), show that lenition and weakening are used as synonyms:

> "Outside the domain of assimilation in place of articulation, the most common segmental interaction between consonants and vowels (or, sometimes, other sonorants) is lenition or weakening. Typical examples of lenition involve either the voicing of voiceless stops, or the voicing and spirantisation of stops..." (Odden, 2005: 239)[7].

> "lenition (also called weakening): consonants can be arranged on scales of strength.... The scales can be summed-up by saying that a consonant is stronger the more it differs from vowels; a consonant becomes weaker the more it comes to resemble a vowel." (Ashby & Maidment, 2005: 141).

Even though the two terms are indistinguishably used, originally, lenition derives from the Latin *lenire* (to soften) and it is not associated with strength or weakness (Thurneysen, 1898). By lenition Thurneysen (1898: 43) simply means "a decrease in the intensity of articulation".

The notion of lenition scale has been extensively debated in theoretical phonology, yet no proposal seems to cover all stages which lead to the total segment loss (Honeybone, 2012). Some hierarchies, for instance, do not include the stage of debuccalisation (e.g. Ewen & van der Hulst, 2001). A compelling proposal, with respect to coronal segments, has been provided by Harris (1994) who considers glottaling as a transitional stage to the segment loss:

[6] It is argued that consonantal strength can be due to the stress or prosodic prominence of syllables (Ladd 1996); the place of articulation of consonants (Foley, 1977); the manner of articulation of consonants and voicing (Honeybone, 2008). Six additional types of consonantal strength which have been identified include "inherent strength, positionally-endowed strength, static comparative strength, strength shown through dynamic spontaneous change, simple non-inhibitory relative strength, and strength to inhibit process-innovation." See Honeybone (2008) for further details.

[7] See Honeybone (2008) for issues which arise from this definition, such as linking lenition to inter-sonorant context.

Plosive > ʔ (Glottaling) > Ø (Deletion).

Kirchner (2004: 3) argues that lenition refers to both diachronic alternations and synchronic sound change "whereby a sound becomes *weaker* or where a *weaker* sound bears an allophonic relation to a *stronger* sound". Despite being a debated issue in the literature, he deems the characterization of *weakening*, in relation to consonants, a "reduction in constriction degree or duration" (Kirchner, 2001: 3). But what type of changes are usually regarded as lenition? This process includes: degemination, such as the reduction of a long to a short consonant; flapping, that is the reduction of a stop to a flap; spirantisation - the reduction from a stop to a fricative or approximant; reduction of other consonants; debuccalisation – the reduction of an oral to a laryngeal (e.g. t → ʔ; s → h); and at its most extreme, complete *elision* (e.g. t → Ø).

Wide attention has been devoted to the lenition of coronal stops in Present-Day English, including Irish English, some other British dialects (e.g. Liverpool English), and American English particularly with respect to 'tapping' or 'flapping'[8] whose application is limited to the intervocalic context v__v, or intersonorant environment (Honeybone 2012). In Liverpool English, all the underlying stops are affected by lenition, especially /t/, /k/, and /d/ (Watson, 2007), where the process of affrication and spirantization are mostly involved. The relationship between t-to-r and t-lenition has been explored in Liverpool English by Honeybone & Watson (2013), who claim that the two phonological processes have different characteristics. Intermediate stages between /t/ and zero were also identified in Dublin English by Hickey (2009b: 400), who suggests that "lenition can be seen as a scale with the full plosive /t/ at one end and zero at the other, with identifiable stages in between." These stages in between are illustrated as follows:

[8] See Carr and Honeybone (2007) for terminological remarks.

(1) Vernacular Dublin English (Hickey, 2009b):

t	-	t̪	-	ʔ	-	h/r	-	Ø
button		*but*		*water*		*water*		*what*

In more standard varieties, however, this process is only attested for the first stage. Indeed, Hickey (2009b) claims that the transitional scale to lenition was not continued in Supraregional southern Irish English as the latter developed among middle class speakers who wanted to distance themselves from vernacular Dublin English, by avoiding glottalisation as an advanced stage of lenition. Therefore, this internal phonetic development of the lenition process is blocked by social motivations, as shown in (2):

(2) Supraregional southern Irish English (Hickey, 2009b):

t	-	t̪
button		*but*

Among those illustrated above, few examples occur in coda position, and none of them occurs in word-final consonant cluster. This is not entirely surprising since C(C)t environments are typically excluded from (t) glottaling analysis[9].

Honeybone (2012) summarises some types of change regarded as lenition and the linguistic contexts in which they occur. The first, *conditioned changes*, can be influenced by neighbouring segments or other phonological properties; the second, *strongly unconditioned changes*, where the phonological environment does not play a prominent role; the third *weakly unconditioned changes*, which are not context-free, but not brought about by the phonological properties of the neighbouring segments. He

[9] See Chapter 5 for a detailed discussion as to why tokens in this linguistic context were typically excluded in previous research.

suggests that "lenition involves only those types of change that can show this weakly unconditioned patterning." (p. 785).

Despite the existence of intermediate stages in the lenition scale, tapping will not be an object of examination in the present analysis for a twofold reason: firstly, taps were not included in the (t) glottaling analysis; secondly, tapping is largely attested in intervocalic position, or medially in tokens such as *winter* (Wells, 1982). Hence, in this Chapter, I will mainly refer to Harris' (1994) lenition scale where the only intermediate segment, prior to elision, is the glottal stop. The focus on lenition, here, largely disregards 'fortition'[10] and 'strengthening' as these notions go beyond the purpose of this survey. Under the light of lenition and the theories of feeding and bleeding, I will attempt to shed light on the appropriate sequences of rule applications.

7.5 A brief account on rule ordering – feeding and bleeding

Determining the sequences of rule applications was a highly debated issue during the nineteen seventies. In the early days of Generative Phonology, the assumption was that rules need to apply in a specific order as part of the grammar of the language.

The major claim, within this aspect of Generative Grammar, is that one rule can influence the operation of a following one. To explain this process, Nathan (2008) provides as an example the transition from coronal stops /t,d,n/ to flaps[11] – a process which is affected by stress. For the next stage - deletion - to occur, there must be a condition which generates the flap formation since flaps are allophones of other sounds. This idea of sequential rule ordering was subsequently called into question as some rules were not structurally connected (i.e. did not have any influence on one another),

[10] It is a hot issue in the literature (cf. Buizza 2011b) as to whether affricates account for lenition or fortition.

[11] Flaps undergo deletion in relatively informal speech style.

hence it would be onerous to match rules which had a different output. A notable contribution to this discussion was provided by Kiparsky (1968) who explored the diachronic rule orderings of languages. His discussion of rule interactions starts by exploring those cases where the application of a rule lays the basis for a later rule to apply. This process is referred to as *feeding* after Kiparsky (1968) as the previous rule feeds the subsequent one, that is "if Rule A increases the numbers of forms to which Rule B can apply, the order A – B is a feeding order" (Gussenhoven & Jacobs, 2011: 114). Besides the flapping and flap deletion phenomena above mentioned, another example of feeding ordering is the rule of fortis plosive insertion which feeds pre-glottalization in British English (Gussenhoven & Jacobs, 2011), is illustrated in the examples below:

Underlying	Fortis stop	Pre-glottalization	
prins	prints	prinˀts	*prince*
leŋθ	leŋkθ	eŋˀkθ	*length*

Conversely, if a previous rule creates a context which prevents the following rule from applying, the rules are claimed to be in *bleeding* order, as the first rule bled the second one. In other words, "if Rule A decreases the number of the forms to which Rule B can apply, the order A – B is in bleeding order" (Gussenhoven & Jacobs, 2011: 115). An example of bleeding order, as reviewed by Nathan (2008) in his commentary on Kiparsky's (1968) discussion, is 'l-darkening'; the allophone of /l/ for numerous speakers is [ɬ] even foot-internally or syllable finally in words like *velar*. However, if the suffix *-ity* is attached to *velar*, the stress shifts to the next syllable resulting in a syllable-initial clear [l]. Therefore, in this case, the stress shift blocked the application of l-darkening. Gussenhoven & Jacobs (2011) illustrates the bleeding ordering through the ɪ-insertion rule between the voiceless alveolar fricative /s/ and its voiced counterpart – the plural marker /z/. The English rule related to the devoicing of segments when

these are followed by voiceless consonants, as in *books* [bʊks], does not apply when /ɪ/ is inserted, as in *buses* [bʌsɪz].

From a maximal rule transparency viewpoint, both feeding and bleeding are treated as natural orders due to their application transparency on the surface. Having reviewed the main points of rule ordering, let us briefly outline the analytical procedures employed before turning the attention to the logistic regression analysis.

7.6 Analytical procedure

The total number of tokens which intersect (i.e. occur for both variables) equals 1,275 - a lower amount than the totals of 4,879 (t, d) and 3,051 for word-final (t), due to the exclusion of C(C)d clusters. In detail, an average of 35.4 occurrences per speaker was analysed – a number which (a) still conforms to the general statistical law, and (b) reaches the ideal of 30 tokens per environment (Erickson and Nosanchuk 1992). In this regard, the present analysis will be only carried out to account for East Anglia as a whole (i.e. by grouping the three localities together) in order not to lower the suggested threshold per environment. Together with glottal replacement with [ʔ], the dataset includes the few cases of glottal reinforcement of [t] with [tʔ] (n = 2) or [ʔt] (n = 12), and the few cases where a period of creaky voice occurred (n = 4).

Commonly, the tool of choice to analyse binary outcomes is logistic regression. However, when a sociolinguistic variable has more than two alterations, multinomial logistic regression seems the appropriate tool. In case the variants are related in an ordinal way, ordinal logistic regression is employed. The drawback of running multinomial models, however, is that we lose the precision we would obtain from the full mixed-effects model. In this respect, Gorman & Johnson (2013: 226) state that "we are unaware of any software that fully supports mixed-effects multinomial models."

Since speakers in the sample produced many tokens, it would be ideal to run a mixed-effects model with a per-subject intercept. Hence, since the previous chapters examined /t,d/ vs. deletion, and /t/ vs. glottaling, in this last chapter I will look at /t/ deletion vs. /t/ glottaling, as a result of parallel models.

Deletion has been selected as application value in the mixed-effects regression analysis following the order of the lenition scale proposed by Harris (1994) - plosive > ʔ (glottaling) > Ø (deletion) - according to which /t/ glottaling is closer than /t/ deletion to what is considered the 'standard'[12]. Treating word-final /t/ glottaling (e.g. *it, get*) as a realisation close to the 'standard' is not surprising since this feature (before a consonant) was found to be well-established even in RP (Kerswill 2007; Barrera 2015). Moreover, Fabricius (2000: 147) suggests:

> "As a recommendation for foreign language teaching then, it seems reasonable to describe t-glottalling as an emerging standard pronunciation in word-final environments."

The computational formula employed for this intersection analysis resembles what is usually referred to as "Labov Deletion" (Rickford et al., 1991: 106), and commonly used in the study of the AAVE copula *be*:

$$\frac{D}{C + D.}$$

In the above formula, *D* stands for deletion (e.g. "He *Ø* talkin), whilst *C* stands for contraction (e.g *I'm here*). Full forms (e.g. *she will be here tomorrow; she was here yesterday*) are not included in the formula (cf. computational formula "Straight Deletion" (Rickford et al., 1991: 106)).

Following the above, the computational formula adapted to explore the intersection of (t) deletion and (t) glottaling in the C(C)t environment is:

[12] In this analysis, treating /t/ glottaling as 'more close to the standard' does not mean that it is more standard that /t/ deletion which never had the same level of stigma attached.

$$\frac{D}{G + D}$$

where *D* represents deletion and *G* represents glottal(ised) forms. Before attempting to answer the above research questions, let us briefly review what is meant by covariation between multiple linguistic phenomena, and how linguists are currently dealing with this issue.

Due to the limited amount of occurrences, in comparison with the main analyses of (t,d) deletion and (t) glottaling, several factor groups had to be collapsed to avoid knock-outs. This prevents us from providing an in-depth account of the linguistic constraints examined, and it is likely that some differences will be concealed. Predictors whose factor weight were the same were collapsed, such as following unstressed syllables and pause, following stops and pause, as well as following liquids and glides. The constraints and their related factor groups included in the statistical best fit model are illustrated in table 7.6.1.[13]

[13] Note that morphological class, with its related factor groups: monomorpheme, semiweak, and regular past tense, is not included in the intersection analysis as this constraint has not been explored in relation to (t) glottaling, neither in the (t) analysis of the present survey nor in previous research on (t) glottaling. Hence, comparing a constraint between two non-standard variables without knowing how it behaves in the (t) vs. /t/ analysis, might lead to misleading results.

Constraints	Factors
Preceding manner of articulation	nasals (e.g. *different*) fricatives (e.g. *left*) /l/ (e.g. *built*) stops (e.g. *asked)*
Following manner of articulation	nasal (e.g. *last month*) fricatives (e.g. *can't help*) stops (e.g. *must be*) + pause (e.g. *she stopped?)* liquids (e.g. *don't like*) + glides (e.g. *Walt was)* vowels (e.g. *went on*)
Syllable stress (on the cluster)	Primary stress – /t/ occurs in primary stressed syllables (e.g. *cost*) Non-primary (e.g. *different*)
Stress on the following syllable	Unstressed (e.g. *past eleven*) + pause (e.g. *agreement*) Stressed (e.g. *best way*)
Voicing Agreement	Homovoiced (e.g. *contact*) Heterovoiced (e.g. *parent*)
Style	Spontaneous speech, reading styles, word lists
Word frequency	low frequency (1-3); high frequency (4-7)
Social class	working class, middle class
Age	young (18-28), middle (35-50), older (60+)
Sex	female, male

Table 7.6.1 Constraints on the intersection between (t) deletion and (t) glottaling.

To my knowledge, the intersection between (t) deletion and (t) glottaling has not been explored prior to this study, therefore this will prevent us from making comparisons with previous research. This discussion, therefore, will be limited to comparison, where possible, with the findings discussed earlier.

7.7 Overall Results and Individual Variation

This section presents the step-up/step-down regression analysis of the above model and reports the findings for the three locations together. The best model achieved in the multivariate analysis shows that preceding environment, following environment, stress on the following syllable, style, sex, and syllable stress (on the cluster) are statistically significant. In the main two analyses of (t,d) deletion and (t) glottaling (e.g. *street*), as discussed in Chapters 4 and 6, none of the social factors surfaced as significant. However, when (t) deletion and (t) glottaling in the C(C)t environment are examined at their intersection, sex emerges as a significant predictor. Further details on the effect of sex will be provided in section 7.7.5. Even though the multivariate analysis does not include the standard [t], figure 7.7.1 illustrates the distribution of /t/ in word-final consonant clusters across the whole lenition scale, in the East Anglian dataset.

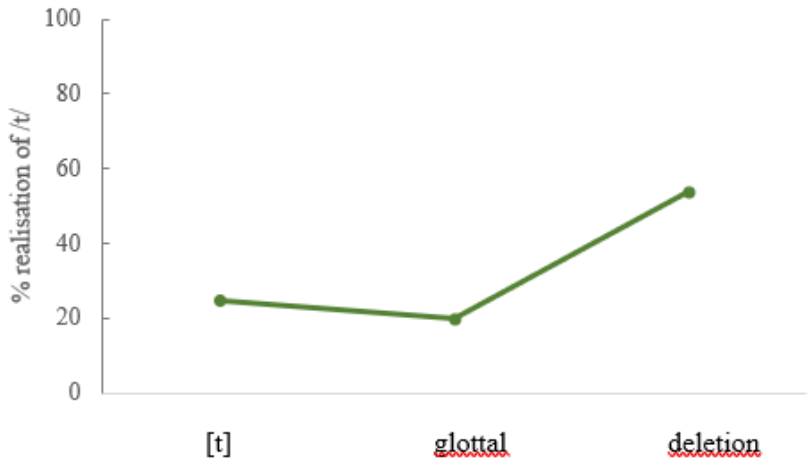


Figure 7.7.1 Distribution of /t/ in word-final consonant clusters.

The sections to follow will be devoted to the predictors which surfaced in the logistic regression analysis (deletion vs. glottaling) in order of statistical significance.

Application value = deletion; overall proportion = 0.725 R^2 = 0.532; log likelihood = -580.158; *N* = 1275				
Constraints	**logodds**	**FW**	**%**	**Tokens**
Preceding environment p<.001				
stops	1.957	0.876	96	47
fricatives	0.937	0.719	89	346
nasals	-0.382	0.406	68	814
/l/	-2.512	0.075	29	68
Following environment p<.001				
nasals	0.589	0.643	92	90
fricatives	0.500	0.622	82	244
pause + stops	0.250	0.562	71	489
vowels	-0.604	0.353	68	264
liquids and glides	-0.735	0.324	65	188
Stress on following syllable p<.001				
unstressed + pause	0.542	0.632	77	949
stressed	-0.542	0.368	59	326
Style p<.001				
reading styles	0.688	0.666	75	247
spontaneous speech	0.443	0.609	73	983
word lists	-1.131	0.244	49	45
Sex p<.05				
males	0.597	0.645	75	664
females	-0.597	0.355	70	611
Syllable stress p<.05				
unstressed	0.195	0.548	70	326
stressed	-0.195	0.452	74	949

Table 7.7.1 Multivariate analysis of /t/ deletion vs. /t/ glottaling.

7.7.1 Preceding phonetic segment

The most robust predictor in the intersection between (t) deletion and (t) glottaling in the C(C)t linguistic context is the preceding phonetic environment, with preceding stops (.88) and fricatives (.72) favouring deletion, while preceding nasal and preceding /l/ disfavour at .41 and .07, respectively[14]. This means that, in word-final consonant clusters, both nasals and /l/ favour (t) glottaling.

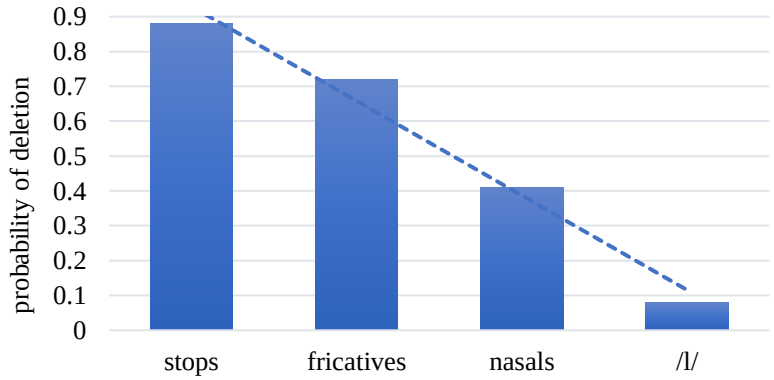


Figure 7.7.2 Probability of deletion according to the preceding phonetic segment.

Interestingly, the preceding environment is the first most weighty constraint bearing a resemblance to the main analysis of glottaling in word-final position (e.g. *hate*), as discussed in Chapter 6. Typically, in binomial models for both (t,d) deletion and word-final /t/ glottaling – where non-standard versus standard features are compared – the preceding linguistic context is not a very powerful predictor: for (t,d), it is considered a "tertiary constraint" (Guy, 1980: 20); for word-final /t/ glottaling, the preceding environment is left unexplored in many British dialects. This finding for East Anglia is thus unprecedented.

[14] It should be highlighted that when preceding /l/, a strongly disfavouring predictor, is excluded from the analysis, stops are the only factor which favours deletion; whereas fricatives and nasals favour /t/ glottaling.

Rice (1992) suggested to also take into account the phenomenon of sonority when discussing phonetic weakening, or lenition. Indeed, sonority seems to be an explanatory factor when moving forward to the lenition scale. The results reveal that less sonorous preceding segments favour deletion,[15] whilst more sonorous segments favour glottal variants. These findings resemble the trend of word-final /t/ glottaling (e.g. *habit*) even in the behaviour of factor groups, with preceding nasals and /l/ triggering the use of the glottal variant, while fricatives and stops disfavoured it.

When examining the distribution of /t/ between the preceding phonetic segment and sex of participants, the trend of men and women goes in the same direction, as illustrated in figure 7.7.3. However, men delete more than women when /t/ follows the lateral /l/, nasals and stops; while women exhibit a greater deletion rate when /t/ follows fricatives.

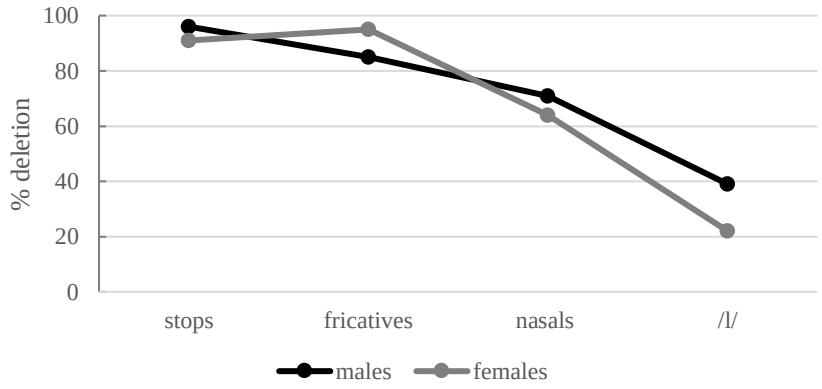


Figure 7.7.3 Deletion by preceding phonetic segment and sex, p <.001.

Before attempting to provide an explanation, let us make some considerations referring back to Harris' (1994) lenition scale (plosive > ʔ > Ø). Deletion represents an advanced weakening stage and glottaling is located in an intermediate position being closer to

[15] This finding is in line with previous North American (t,d) studies (e.g. Santa Ana, 1996), however note that Santa Ana (1996) examined /t,d/ deletion over standard /t/, thus the comparison with the above results is not entirely the same.

the 'standard' /t/ [16]. Word-final /t/ glottaling (before a consonant) is now attested even in RP (Kerswill 2007; Barrera 2015), and the lack of social effect found in recent word-final /t/ research (e.g. Holmes-Elliott 2019; Chapter 6 of the present study) appears to add to the 'loss of stigma' argument. This leads us to suggest that, if the glottal stop is losing its stigma in word-final /t/ (e.g. *opposite*), it should not be surprising to find men favouring deletion in the C(C)t environment – the stage of lenition.

7.7.2 Following phonetic segment

The second most significant predictor is the following phonetic environment, with nasals (.64), fricatives (.62), stops and pauses (.56) favouring deletion, while vowels (.35), liquids and glides (.32) disfavour it. Since the probability values for pause and stops were the same, the two factor groups were collapsed into one category. Similarly, liquids and glides were grouped together due to probability similitude.

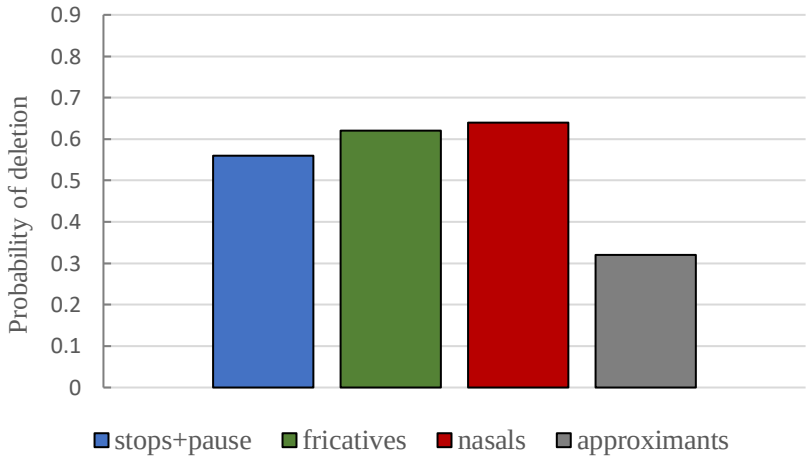


Figure 7.7.4 Probability of deletion according to the following phonetic segment.

[16] This lenition hierarchy, however, does not seem to be universal as there are dialects of English which show T-deletion but not T-glottaling. In those cases, the glottal stop cannot be considered an intermediate stage between /t/ and zero.

Figure 7.7.4 shows that the probability of deletion slightly changes when running a binomial model with two non-standard variables. Indeed, while the behaviour of nasals, stops, vowels, and glides resembles (t,d) results found for East Anglia, the behaviour of following pause differs. In Chapter 4, we saw that following pause is marked as a disfavouring factor in the three localities, so /t,d/ is more likely to be retained[17]. When /d/ is left out of the dataset, and when deletion is compared over glottaling, pause seems to favour /t/ reduction. The high rate of deletion before fricatives is not surprising since they were strongly marked as a disfavouring factor in the (t) analysis (see Chapter 6). Sonority does not play a key role in this linguistic environment, as nasals, the most favouring predictor, are followed by less sonorous segments such as fricatives and stops whose probabilities of deletion are slightly lower.

Crosstabulation between the following phonetic environment and sex, as in 7.7.5, shows that women are very slightly ahead of males in the deletion of /t/ before following nasals; while in every other environment males are leading. If compared to figure 7.7.2 we can observe that deletion is led by males in the same factor groups (stops and liquids) in both preceding and following environments.

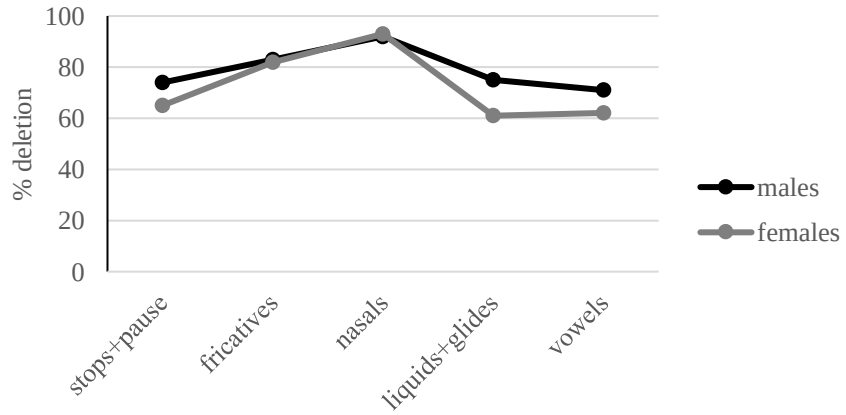


Figure 7.7.5 Deletion by following phonetic segment and sex, $p < .001$.

[17] Following pause is also a disfavouring factor for /t/ glottaling, see Chapter 6.

7.7.3 Stress on the following syllable

The third most significant predictor which surfaced in the mixed-effects logistic regression is stress on the following syllable. This predictor has been included in the present analysis following Rice's (1992) suggestion to consider sonority when taking lenition into account[18]. By way of theoretical background, sonority is argued to be influenced by prosodic factors (de Lacy, 2007), hence, the inclusion of this predictor is used as a means of explaining the role of sonority in this weakening process. The sonority scale I will refer to is the following, after Clements (1990):

VOWELS > GLIDES > LIQUIDS > NASALS > OBSTRUENTS

The view of treating the sonority scale as universal is at odds with recent alternatives advocated by Prince (2001) and de Lacy (2006) who suggest to "avoid positing universally fixed ranking." A more gradient approach proposes that the sonority of sounds can slightly oscillate depending on the syllable position they are in; or it can differ based on the physiological properties of the speakers, such as intensity, duration, etc. (Parker, 2002). Since, however, sonority is not crucial in this work, I will not discuss this point further. In Chapter 3 we saw that sonority governs (t,d) in numerous North American studies (e.g. Santa Ana, 1996), yet in East Anglia and other British dialects sonority is not an explanatory factor for word-final /t,d/ reduction.

[18] What is usually referred to as 'strength', as opposed to a weak sound, is also simply called sonority.

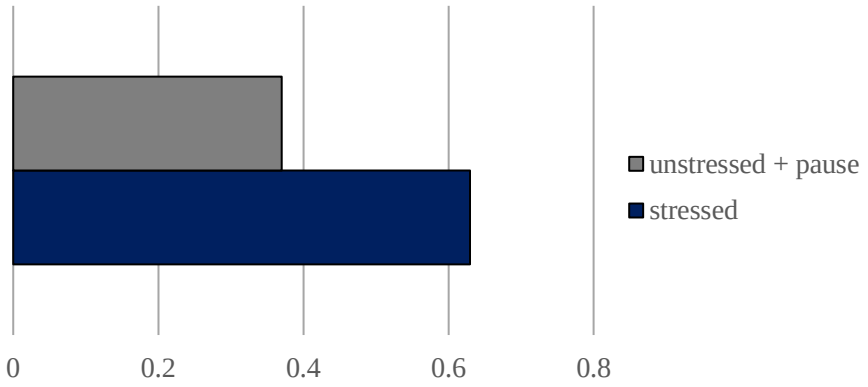


Figure 7.7.6 Probability of deletion by stress on the following syllable.

Turning back to the intersection, figure 7.7.6 reveals that following unstressed syllables and pause are more likely to favour (t) glottaling, whereas following stressed syllables trigger (t) deletion. Among the unstressed syllables a high number of tokens (*N* = 22) is represented by following schwa (e.g. *passed away*) which, being a vowel, is the first most sonorous feature of the sonority scale. Hence, the more sonorous the following segment, the less likely is deletion to occur. This finding is not surprising, as following vowels are typically marked as a disfavouring factor for (t,d) due to resyllabification processes, as discussed in Chapter 4. In this case, instead of referring to the resyllabification of /t/ onto the following vowel since the voiced plosive is left out of the analysis, the use of the glottal stop might suggest an approach to increase the difference in terms of sonority between syllable coda (less sonorous than vowels) and the syllable onset[19].

Following syllables which hold a prominent stress are mainly fricative-initial (*N* = 177/614)[20] followed by stops (*N*= 151/614). This finding, linked to the sonority

[19] A similar explanation was provided by Fuchs (2015), who explored word-initial glottal stop insertion in V#ʔV and C#ʔV positions, to explain the use of glottal stop insertion after sonorants.
[20] This shows the highest number of tokens among following stressed syllables where /t/ deletion occurs.

hierarchy, reveals that less sonorous following segments trigger /t/ deletion. Overall, it seems that the second stage of lenition – (t) glottaling – occurs if the following segment is not stressed; whereas the last weakening stage – deletion – takes place when followed by stressed syllables.

7.7.4 Style-shifting

The fourth most favoring predictor which surfaced in the mixed-effects regression analysis is style. Reading styles and spontaneous speech favor deletion at 0.67 and 0.60, respectively; whereas word lists disfavour at 0.24. This implies that, when deletion is examined against glottaling, a higher use of glottal stops occurs when words are realized in isolation. Considering the increase of glottals across speech styles in the binary analysis of [ʔ] vs. /t/ (e.g. *forget*), as discussed in Chapter 6, it is not unexpected to find a relatively high rate of deletion in spontaneous speech and reading styles in word-final consonant cluster, where Ø vs. [ʔ] are examined at their intersection. This suggests that the speakers might be advancing towards the lenition scale, moving from [ʔ] to zero Ø in the C(C)t context.

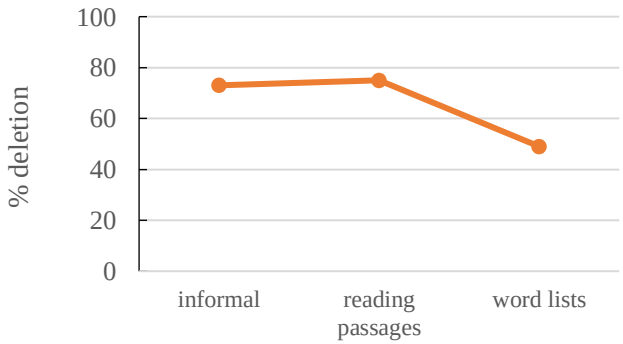


Figure 7.7.7 Probability of deletion in the C(C)t linguistic context, across style.

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Along this line, it should not be surprising to find word lists disfavouring deletion (and thus favouring glottaling). Indeed, in the (t) analysis discussed in chapter 6, /t/ is typically realised as an apical stop in words in isolation; therefore, when moving towards the lenition scale, the underlying /t/ is expected to be realised with glottal variants first – the second stage of lenition – before being eventually deleted.

The influence of syllable stress on the word-final cluster is discussed below in 7.7.6, as it is the least significant predictor.

7.7.5 Sex

The fourth statistically significant predictor, and probably the most salient as a sociolinguistic explanatory factor, is sex. Figure 7.7.8 illustrates that females adopt glottal variants more than males, whilst males delete /t/ more than females.

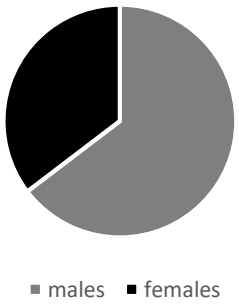

Figure 7.7.8 Probability of deletion by sex of participants.

If deletion is regarded as the most advanced stage of lenition, if the segment loss is treated as a stage weaker than glottaling, and if glottaling is well-established even in RP in word-final position, it is not surprising to find males performing more lenition. Another way of saying this, however, is that for the variable which is stable males delete more, whereas for the variable which is a change in progress women are leading by glottalling more. This finding confirms results from chapter 4, with males being in

the right direction and leading in the deletion of /t,d/[21], whilst results from chapter 6 showed that males glottal more than women when /t/ occurs word-finally (i.e. /t/ after a preceding vowel (e.g. *that*) and /t/ after a preceding consonant (e.g. *silent*)). This suggests that women are leaders in the use of glottal variants in a more specific environment, that is when /t/ occurs in word-final consonant cluster (e.g. *silent*). A closer inspection shows that this trend also holds across different speech styles, as in figure 7.7.9.

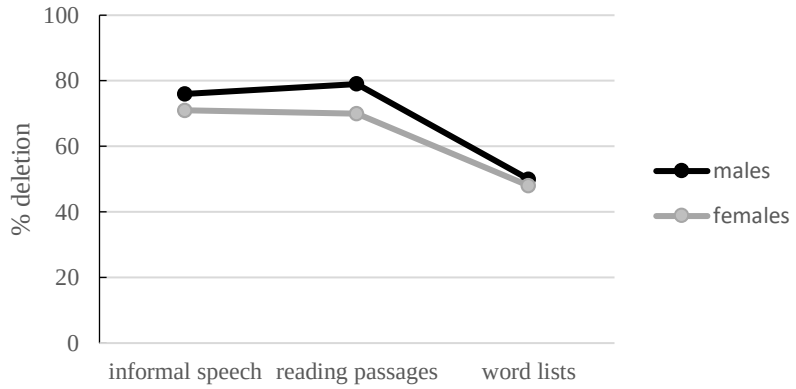

Figure 7.7.9 Rates of deletion by style and sex.

7.7.6 Syllable stress

The least statistically significant predictor is syllable stress on the word-final cluster. This constraint was included in the model as English is a stress-based language and "East Anglian dialects of English show greater stress-effects than most others" (Trudgill, 2018). Viewed through the lens of lenition, coronal /t/ is more likely to undergo deletion in unstressed clusters, whereas in stressed ones /t/ is subject to glottaling.

[21] However, sex was not marked as a significant predictor for (t,d).

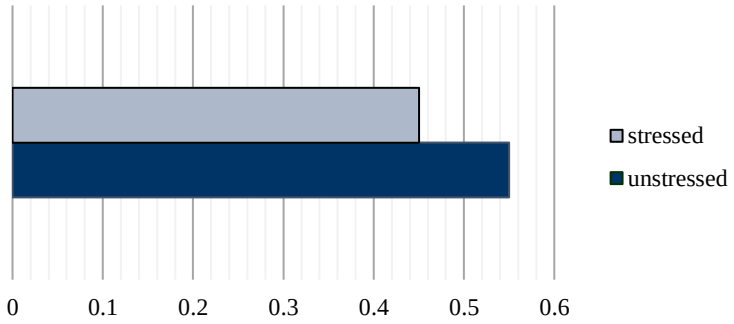

Figure 7.7.10 Probability of deletion by syllable stress.

In line with phonological theory, Schiering (2006, cited in Trudgill 2018) claims that stress-based phonologies exhibit a "strong erosive force in reducing and deleting unstressed syllables."

7.8 Summary

This Chapter has attempted to examine the intersection between (t) deletion and (t) glottaling in the C(C)t environment. Overall, results show that the frequency of deletion remains reasonably stable if results are compared to findings for the complete set of (t,d) forms (see Chapter 4). The influence on the variation of underlying /t/ through the lenition scale is linguistically driven, suggesting that (t) glottaling and (t) deletion in word-final consonant cluster are in *feeding* order, i.e. glottalling can lead to deletion[22]. Sex is the only statistically significant social predictor: when looking at the lenition scale women seem to prefer the use of the glottal stop, whereas in men's speech /t/ undergoes more deletion. The age of participants, social class, voicing agreement and word-frequency do not play a relevant role. Numerous questions, however, remain open to discussion (e.g. how should frequencies of deletion and glottaling in the C(C)t context be properly counted?).

[22]This does not apply to all English dialects as, for some dialects that have both (t) deletion and (t) glottaling, the diachronic ordering seems to be T-deletion > T-glottaling.

Chapter 8 - CONCLUDING REMARKS AND FUTURE WORK

This research has focused on two well-studied phonological features: (t,d) deletion and (t) glottaling by preserving the structuralist roots of the variationist paradigm (see Wolfram 1993; Patrick 1999). Along this line, this survey has treated covariation of explanatory linguistic factors as a prime goal and has shed light on the intersection between two linguistic variables: (t) deletion and (t) glottaling in word-final consonant clusters. This chapter brings together the findings of the target phonological variables, summarises their sociolinguistic status and proposes directions for future work.

Overall results suggest that the profile of (t,d), in East Anglia, is that of a stable variable as none of the social factors examined (social class, age and sex) reached statistical significance. However, when the three communities were investigated separately, the only social predictor which surfaced in the multiple logistic regression analysis is sex in Norwich. The fact that age is not significant in any of the three communities suggests that (t,d) has probably been stable over years, at least in apparent time.

Conversely, in some northern English varieties social factors play a remarkable role such as in Tyneside English (social class, age and sex). In this variety (t,d) is advancing through the life cycle of phonological processes resulting in the incoming stem-level progression. This suggests that BrE dialects are behind US dialects in terms of stem-level – a result which could explain the lack of morphological effect in York. In East Anglia, rates of deletion are lower than Manchester and even lower than York,

except for monomorphemes, yet there is no evidence of change in progress. Its status of a stable variable, in East Anglia, aligns with previous US English studies.

Unlike previous research carried out on (t,d), the present study removes all actually-glottalled/glottalized tokens from the (t,d) database. This survey has also shed light on the unsolved problem of morphological effect in British English dialects (I refer specifically to those studies which treated (t,d) as one variable, such as York, Manchester and Tyneside English) reporting the emergence of the expected morphological effect for (t,d) in East Anglia, with *n't* negative contractions and monomorphemes favouring deletion, whereas semi-weak verbs and regular past tense verbs disfavour it. The strong morphological effect is proven by the consistency of the above findings in all three speech communities.

With respect to phonological constraints, I have proposed a closer inspection into the following phonetic segment whose robust effect in British English mirrors that of previous studies. The present survey has shown that the classical coding (obstruents > glides > /r/> /l/ > vowels > pause) is not sufficient to account for this universal constraint, and has revealed salient phonological differences which surfaced after breaking down the obstruent category. It is likely that these differences, as summarised below, might have been obscured in previous research: (a) sibilants and non-sibilant fricatives in the following environment were found to behave very differently - the former strongly favours deletion, whereas the latter strongly disfavours it; (b) following initial /h/ plays a prominent role as (t,d) is highly retained whether following initial /h/ is dropped or not. This finding helps to explain why non-sibilant fricatives strongly disfavour deletion, and points the way to future investigation on (t,d) in English dialects where following /h/ is either frequently retained or frequently dropped.

Some predictors still deserve a closer examination, such as /t,d/ after a preceding /l/. In this study, /l/ was coded as a lateral when it was phonetically consonantal, yet when /l/ was vocalised it was coded in the vowel category. In future research, it would be interesting to compare the rates of (t,d) deletion after a preceding consonantal /l/ and rates of (t,d) absence after a preceding underlying /l/ which undergoes vocalisation to observe any potential difference.

From a theoretical viewpoint, Lexical Phonology does not provide an explanation which holds for these data (the probability of retention for monomorphemes is comparatively lower than that of regular verbs), and the Competing Grammars approach revealed that (t,d) does not appear to vary due to morphological absence in semi-weak verbs. The OCP, according to which the more features of phonetic context are shared with /t, d/, the more likely deletion is to occur (Guy & Boberg 1997), does not hold for the East Anglian data either. Sonority, whose hypothesis is that less sonorous preceding segments favour deletion, appears not to be an explanatory factor in East Anglia as nasals occur at the top of the ranking in the preceding phonetic environment. Word-frequency did not surface as a significant predictor.

The second target linguistic variable was (t) glottaling which has been examined in both word-final and word-medial positions. Nearly 20 years ago, Milroy et al. (1994) argued that linguists do not seem to have an accurate idea of the main constraints that govern this variable. 20 years later, Schleef (2013: 202) claimed that what was previously described by Milroy et al. (1994) "has barely changed." Since this variable has been greatly explored in relation to the following phonological environment – commonly divided into three main phonological contexts: PreC (e.g. *that man*), PreV (e.g. *that apple*) and PreP (e.g. *what?*) (e.g. Williams & Kerswill 1999;

Straw & Patrick 2007), the present survey has contributed to a closer examination of this constraint by providing a finer distinction of the above classical coding. Moreover, this study has examined the role of the preceding phonological environment, which has received little attention in the (t) literature so far.

Overall results showed that word-final /t/ glottaling has completed its social change in East Anglia, indeed none of the social factors was found to be statistically significant. This finding resembles recent research carried out in the UK (e.g. Holmes-Elliott, 2019), and appears to add to the general 'loss of stigma' argument. The largely ignored preceding phonological environment turned out to be the most powerful constraint. Glottaling in post-sonorant position (e.g. *bolt*, *ant*) did not occur categorically, indeed overall results reported a rate of 74% and 57% for /t/ post-nasals and post-laterals, respectively – a finding which is in contrast with the high rates of glottaling found in Manchester in the same contexts (see Baranowski & Turton, 2020). Findings from East Anglia suggest that word-final /t/ glottaling is diffusing in phonological space even in environments where it used to be blocked. The role of frequency, even in this case, was not statistically significant.

A direction for future research relates to word-frequency. The latter was not marked as a significant predictor in the present study, yet recent research (Purse & Tamminga, 2019) suggests that different measurements of frequency (e.g. the frequency of the root) has a significant statistical effect for some linguistic variables. Besides testing the effect of root-frequency, it would be also interesting to explore differences and correlations between the low/high frequency of root and the low/high frequency of suffix in East Anglian English.

Whole-word frequency, however, was found to be an explanatory factor for word-medial /t/ glottaling – a change in progress which has not reached social completion

yet in East Anglia. Indeed, sex and age of participants were marked as significant predictors. Given the above results linked to word-frequency, could there be a potential relationship between whole-word frequency and variables which are still progressing in the change? Word-medial /t/, in East Anglia is less advanced and it is spreading both socially and linguistically. Overall results showed that young males are ahead of females and that word-medial /t/ is also spreading after a preceding schwa – an environment previously blocked, at least in Norwich. Syllable stress was marked as the least predictor to condition /t/ glottaling word-medially, with non-primary syllable stress (e.g. *community*) favouring the non-standard variant and primary syllable stress disfavouring it (e.g. *Westminster*). The sonority hierarchy is an explanatory factor as more sonorous preceding segments were found to trigger the glottal stop. In terms of spatiality, Norwich appears to be ahead of Colchester and Ipswich in the word-medial rule application, as also indicated by the lack of social effect.

The last part of this work has focused on the covariation between (t) deletion and (t) glottaling in the C(C)t linguistic context to explore the interplay between multiple variable phenomena in the three speech communities. Overall results showed that when moving towards the lenition scale (see Harris, 1994) linguistic factors play a remarkable role, with less sonorous preceding segments favouring deletion, whereas more sonorous ones favour (t) glottaling.

With respect to style-shifting, it appears that the speakers are advancing towards the lenition scale moving from [ʔ] to zero Ø, showing that (t) glottaling and (t) deletion are in feeding order. Sex is the only social factor which reached statistical significance with males being ahead of females in favouring deletion – the last stage of the lenition scale. Future research on the intersection of these two non-standard features, in the C(C)t context, could consider applying alternative methods to compute the incidence of

deletion. Since the computational formula employed in the present survey has been adapted from what is commonly referred to as "Labov Deletion" (Rickford et al., 1991: 106), it would be interesting to observe whether the application of the "Straight Deletion" formula (Rickford et al., 1991: 106) could affect the results. The "Straight Deletion" formula, adopted to examine the variation of copula *be* in AAVE, includes the full form of the copula *be* variable (e.g. *was*); whereas in the present survey the label "full form" could be intended as the first stage of the lenition scale (i.e. the realisation of the standard plosive [t]). Rickford et al. (1991) show that the application of different computational formula can affect the overall outcome and, along the line of their results, it would be no surprise if the overall deletion rate was lower when employing the "Straight Deletion" method.

Romaine (1984: 228) suggests that "by looking at the way in which variants distribute themselves synchronically in the social structure of a speech community and understanding the social meaning that are attached to them, we get some idea of relative chronology and directionality." When taking into account the directionality of a variable in time, social and linguistic space, I would suggest considering whether it intersects with other linguistic variables. The examination of both linguistic and social patterns involved in the intersection will provide a thorough understanding of the concepts of stability vs. change in progress and could be also valuable for sociolinguistic reconstruction tasks. The present survey, unusual in highlighting intersection, suggests that stable variables like (t,d) are only stable when they do not intersect with ongoing changes - including late-stage changes like word-final /t/ glottaling. Intersection analyses also add to our understanding of (a) reactivation of change and (b) completion of change. It is a core principle in variationist sociolinguistics to distinguish language change from variation. A prerequisite of

language change is variation, but some variation involves no change and can be stable over time. Social distribution can mark the endpoint of a change, that is, absence of variation by age, gender, social class, neighbourhood or ethnicity implies the completion of a change (Labov, 2010). In the case of (t) glottaling and (t,d) deletion in the UK, Milroy et al. (1994) argue that, in Newcastle, the glottal variant is a supra-local change and women are instrumental in the diffusion of these non-standard variants (for similar results in Sunderland see Burbano-Elizondo, 2015); Woolford (2018) shows that, in Tyneside English, (t,d) is advancing through the life cycle of phonological processes, as opposed to East Anglia where (t,d) is a stable variable and word-final /t/ glottaling is a late-stage change. This suggests that when glottal forms began to spread in some areas of the UK, (t,d) became 'changing' again (e.g. reactivation of change); as glottaling goes to completion, (t,d) becomes stable (e.g. completion of change)

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Appendix I

Non-significant predictors for (t,d) deletion – overall results.

Constraints	%	Tokens
Syllable stress		
unstressed	45	773
stressed	22	4106
Sex		
Males	27	2617
Females	25	2262
Age		
middle-aged	26	1631
Young	26	1595
Old	25	1653
Class		
working-class	27	2388
middle-class	25	2491
Location		
Colchester	26	1658
Ipswich	26	1615
Norwich	25	1606

Appendix II

Non-significant results for word-final /t/ glottaling – overall results.

Constraints	%	Tokens
Sex		
Males	72	1561
Females	69	1490
Age		
young	75	1039
middle	74	992
old	65	1020
Social class		
working class	72	1464
middle class	69	1587
Location		
Ipswich	73	1114
Colchester	73	1097
Norwich	64	840
Lexical frequency		
high	70	2882
low	58	169

Non-significant predictors for word-medial /t/ - overall results

Constraints	%	Tokens
Social class		
WC	41	887
MC	32	985
Location		
Ipswich	39	694
Colchester	39	578
Norwich	30	600