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EXPLORING THE INTERSECTION OF TWO LINGUISTIC VARIABLES IN BRITISH ENGLISH DIALECTS

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Abstract – The bulk of sociolinguistic research has focused on covariation between linguistic variables and social factors e.g. when a phonological variable is involved in covariation with social variables or other linguistic variables (Trudgill 1974). Recent research, however, note that little attention has been devoted to how multiple linguistic variables are interrelated in a given speech community (Guy, Hinskens 2016). Along this line, this paper investigates the covariation of two linguistic variables which intersect in British English: (t)-deletion and (t)-glottaling in the C(C)t linguistic context (e.g. *want, kept*). Data was gathered from 36 participants by means of sociolinguistic interviews, reading passages, and word lists in three British speech communities. 1,275 tokens were gathered. Data was transcribed in ELAN, with support from visual cues in the spectrogram in PRAAT, and mixed-effects logistic regression analyses was carried out. Results show that less sonorous preceding segments favour (t)-deletion, whereas more sonorous ones favour (t)-glottaling. The preceding and following phonological environments, syllable stress, style, and sex of participants were also found to play a significant role.

Keywords: intersection; British English dialects; phonology; language variation.

1. Covariation between linguistic variables

Most of sociolinguistic research deals with covariation between linguistic variables and social factors. Trudgill (1974, p. 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 on linguistic/social covariation has been later expanded including covariation of explanatory linguistic factors as prime goal (Patrick 1999; Wolfram 1993). In this paper, I 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 (Anttila 2002b).

In a volume devoted to the theme of covariation between linguistic variables, Guy and Hinskens (2016, p. 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 and 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, p. 169). This explains the high /t,d/ deletion rate in regular past tense verbs which is due to morphological absence (Patrick 1999).

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, p. 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, p. 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,[1] 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. This paper, conversely, deals with the covariation between two non-standard features: (t)-deletion and (t)-glottaling in the C(C)t linguistic context.

[1] The vowels investigated include the following lexical sets: FACE, PRICE, TOOTH, DOWN, GOAT, THOUGHT.

1.1. Research Questions

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]. 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. By means of mixed-effects binary logistic regression analysis we will be able to observe patterns of variation (see section 6.2). The research questions which arise in this regard are summarised as follows:

(1) Does intersection change the frequency of deletion?
    - of glottal forms?

(2) How should they be properly counted?

2. 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. [kɑːn]) or may have a glottal gesture (e.g. [kɑːnʔ]).[2] 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, whilst the latter will be called (t)-glottaling in the C(C)t context.

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 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* [sɛʔn̩ˈhanʔʔʃɒps], 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 (Fasold 1972) and Norwich English. With respect to Norwich English, Trudgill (1974) shows that final *-ed* can be realised as /-ət/; thus, the voiceless alveolar is likely to be replaced by the glottal stop as in *hundred* [hʌndɹəʔ].

3. Status of the two phonological variables in Eastern England

The status of (t,d) deletion, in East Anglia, is that of a stable variable (Ciancia, Patrick forthcoming); 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 the social change has reached an endpoint in spontaneous speech (Ciancia forthcoming). Word-medial /t/ glottaling, by contrast, is both phonetically and socially conditioned in Eastern England (Ciancia 2023).

[2] The terms *intersection* and *covariation* will be used interchangeably in this paper.

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/. 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.* (2020) recently noted. Thus, this paper provides a contribution in this respect.
The following sections provide a brief account on lenition, and the rule ordering of feeding and bleeding, which can help shed light on the (t)-deletion/(t)-glottaling intersection.

4. A brief account on lenition

The terms *lenition* and *weakening* are interchangeably used in phonology (e.g., Carr 1993; Hock, Joseph 1996) and imply a notion of consonantal strength (Ashby, Maidment, 2005).[3] According to Lass and Anderson (1975, p. 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, p. 239).[4]

> 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, p. 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, p. 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 (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:

Plosive > ʔ (Glottaling) > Ø (Deletion).

[3] 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).

[4] See Honeybone (2008) for issues which arise from this definition, such as linking lenition to inter-sonorant context.

Kirchner (2004, p. 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, p. 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'[5] 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 and 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, p. 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:

(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 analyses.

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

[5] See Carr and Honeybone (2007) for terminological remarks.

about by the phonological properties of the neighbouring segments. Honeybone (2012, p. 785) suggests that "lenition involves only those types of change that can show this weakly unconditioned patterning." 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 paper, 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' 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.

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[6] – 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), 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, p. 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	prinʔts	*prince*
leŋθ	leŋkθ	eŋʔkθ	*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, p. 115). An example of bleeding order is 'l-darkening'; the allophone of /l/ for numerous speakers is [ɫ] 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].

[6] Flaps undergo deletion in relatively informal speech style.

Therefore, in this case, the stress shift blocked the application of l-darkening. Gussenhoven and 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 in this study before turning the attention to the logistic regression analysis.

6. Methods

6.1. Data Collection and Coding

Data for this study was gathered from 36 East Anglian participants from Colchester (Essex), Ipswich (Suffolk), and Norwich (Norfolk), who were socially stratified by social class, age, and sex. Data was transcribed in ELAN and transcribed auditorily, with support from visual cues in the spectrogram in PRAAT. 1,275 tokens were analysed. In detail, an average of 35.4 occurrences per speaker was examined– a number which (a) conforms to the general statistical law, and (b) reaches the ideal of 30 tokens per environment (Erickson, Nosanchuk 1992). In order not lower the suggested threshold per environment, the three localities are grouped together in the multivariate analysis.

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).

The independent variables include:

- preceding phonological environment: nasals (e.g. *different*), fricatives (e.g. *left*), laterals (e.g. *built*), and stops (e.g. *asked);*
- following phonological environment: nasals (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)*, and vowels (e.g. *went on*);
- syllable stress (on the consonant cluster), where /t/ occurs in the primary stressed syllables (e.g. *cost*), and where /t/ occurs in non-primary (e.g. *different*);
- syllable 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*);
- Word frequency: low frequency (1-3); high frequency (4-7);
- Social class: 18 working-class speakers, 18 middle class speakers. The social class of participants was measured according to the European Socio-Economic Classification (ESeC) (Rose *et al.* 2010).
- Age: young (18-28), middle (35-50), old (60+);
- Sex: 18 males, 18 females;
- Style: spontaneous speech, careful speech, word lists.

6.2. Statistical tool

Logistic regression analysis, with speaker and word as random effects, was carried out in Rbrul (Johnson 2009). 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 and Johnson (2013, p. 226) state that "we are unaware of any software that fully supports mixed-effects multinomial models".

In this study, the application value is (t)-deletion, 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'.[7] 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 (Barrera 2015; Kerswill 2007). Moreover, Fabricius (2000, p. 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, p. 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, p. 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:

$$\frac{D}{G + D}$$

where *D* represents deletion and *G* represents glottal(ised) forms.

Predictors whose factor weights 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 1.[8] To my knowledge, the intersection between (t)-deletion

[7] 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.

[8] 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)

and (t)-glottaling has not been explored prior to this study, therefore this will prevent us from making comparisons with previous research.

7. Results and Discussion

This section presents results from the logistic regression analysis and reports the findings for the three locations together. Before discussing the statistical findings, let us show the distribution of /t/ in word-final consonant clusters across the whole lenition scale, in the East Anglian dataset (see Figure 1).

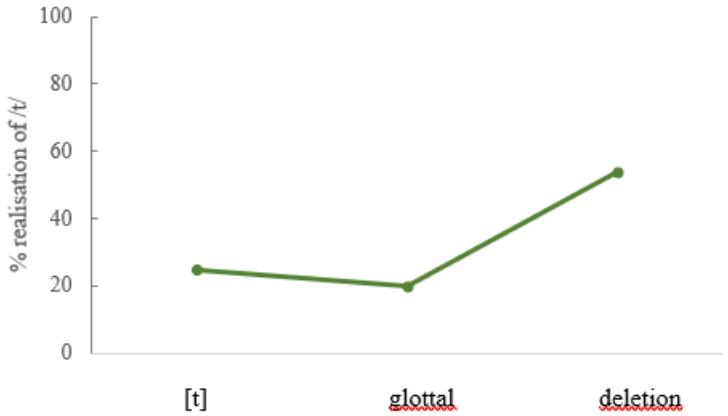

Figure 1
Distribution of /t/ in word-final consonant clusters in the East Anglian dataset.

The best model achieved in the multivariate analysis shows that preceding phonological environment, the following phonological environment, stress on the following syllable, style, sex, and syllable stress (on the cluster) are statistically significant predictors.

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.

Application value = deletion; overall proportion = 0.725				
R^2 = 0.532; log likelihood = -580.158; *N* = 1,275				
Constraints	**logodds**	**FW**	**%**	**Tokens**
Preceding environment				
stop	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				
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				
unstressed + pause	0.542	0.632	77	949
stressed	-0.542	0.368	59	326
Style				
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				
males	0.597	0.645	75	664
females	-0.597	0.355	70	611
Syllable stress				
unstressed	0.195	0.548	70	326
stressed	-0.195	0.452	74	949

Table 1
Logistic regression analysis of /t/ deletion vs. /t/ glottaling.

In the main two analyses of (t,d) deletion (Ciancia, Patrick 2019, forthcoming) and (t)-glottaling (Ciancia 2021, forthcoming), none of the social factors surfaced as significant.[9] However, when (t)-deletion and (t)-glottaling in the C(C)t context are examined at their intersection, sex emerges as a significant predictor.

The sections to follow will be devoted to the predictors which surfaced in the logistic regression analysis in order of statistical significance, as indicated in Table 1.

[9] See section 3 for information related to the current status of the two linguistic variables in Eastern England.

7.1. Preceding phonological environment

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.[10] This means that, in word-final consonant clusters, both nasals and /l/ favour (t)-glottaling.

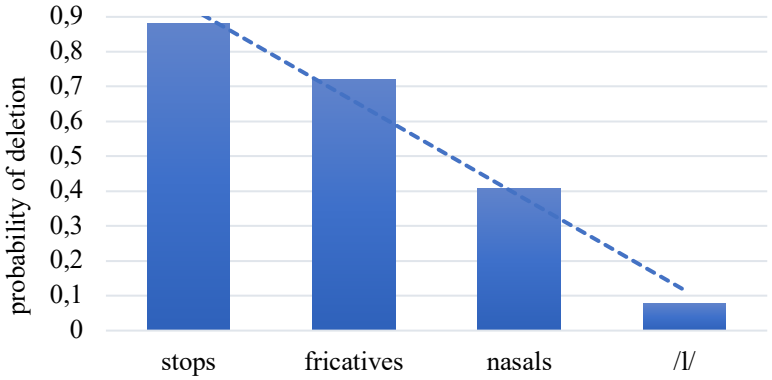

Figure 2
Probability of deletion according to the preceding phonetic segment.

According to Rice (1992), sonority plays an important role on 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[11] 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. Interactions between the preceding phonetic segment and sex of participants show that the trend of men and women goes in the same direction, as illustrated in Figure 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.

[10] Note 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.

[11] 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.

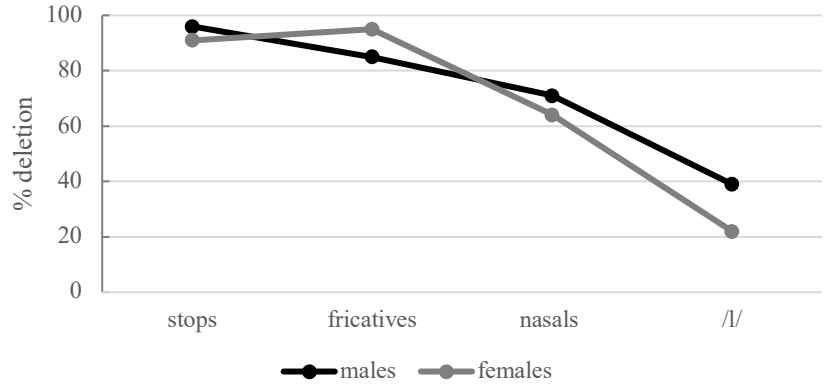

Figure 3
Deletion by preceding phonetic segment and sex.

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 the 'standard' /t/.[12] Word-final /t/ glottaling (before a consonant) is now attested even in RP (Barrera 2015; Kerswill 2007), and the lack of social effect found in recent word-final /t/ research 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.

7.2. Following phonological environment

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 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 (Ciancia, Patrick 2019), the behaviour of following pause differs. Ciancia and Patrick (2019) show that following pause is marked as a disfavouring predictor in the three localities, so (t,d) deletion is more likely to be retained. When /d/ is left out of the dataset, and when deletion is compared over glottaling, as in the present study, pause seems to favour /t/ reduction. 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.

[12] 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.

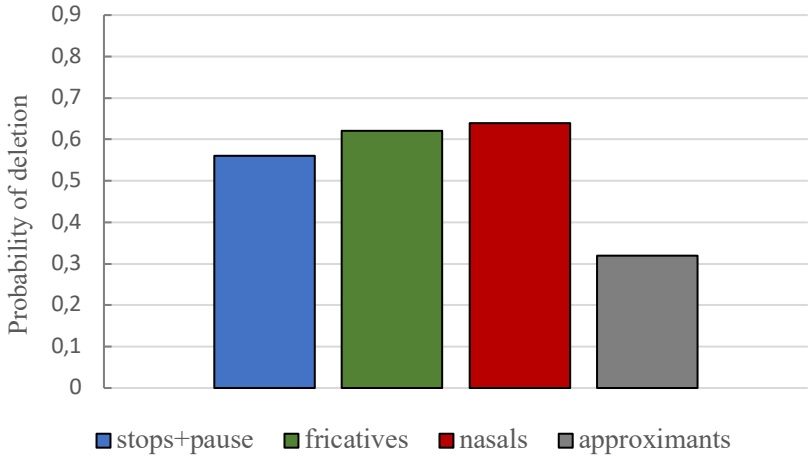

Figure 4
Probability of deletion according to the following phonetic segment.

Crosstabulation between the following phonetic environment and sex, as in Figure 4, shows that males while males are leading in the deletion of /t/ in each linguistic context except for following nasals where females are very slightly ahead of males.

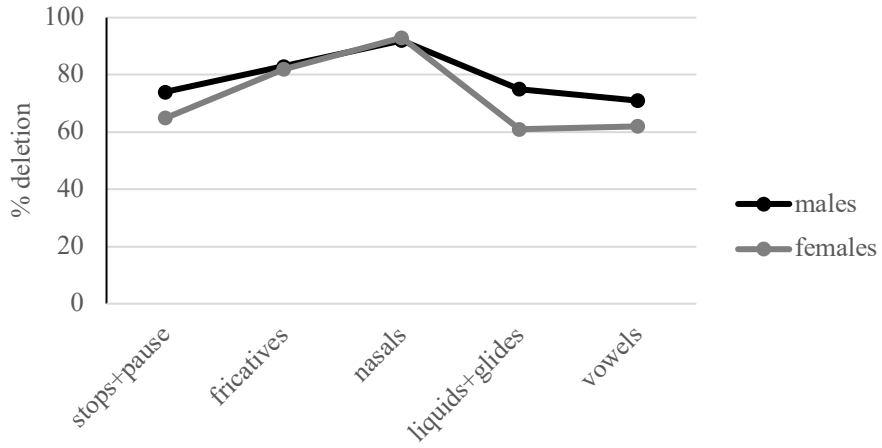

Figure 5
Deletion by following phonetic segment and sex.

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.[13] 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

[13] What is usually referred to as 'strength', as opposed to a weak sound, is also simply called sonority.

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

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)., Sonority, however, is not crucial in this work, thus I will not discuss this point further.

Figure 6 shows 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. In this case, 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.[14]

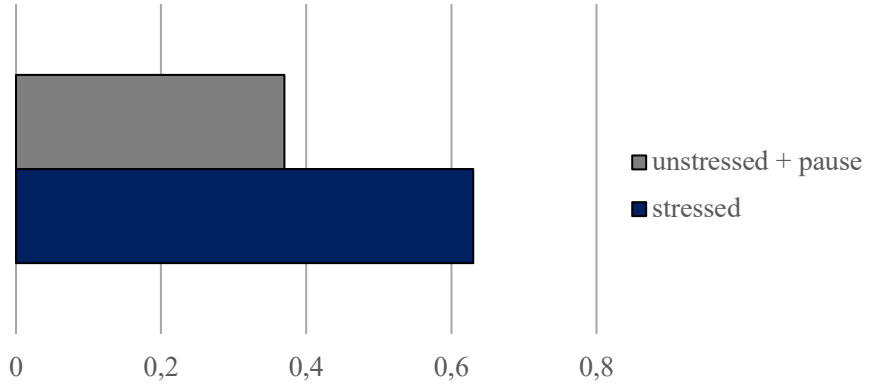

Figure 6
Probability of deletion by stress on the following syllable.

Following syllables which hold a prominent stress are mainly fricative-initial (*N* = 177/614)[15] followed by stops (*N*= 151/614). This finding, linked to the sonority hierarchy, reveals that less sonorous following segments trigger /t/ deletion. Overall, it seems that the second stage of lenition – glottaling – occurs if the following segment is not stressed; whereas the last weakening stage – deletion – takes place when followed by stressed syllables.

[14] 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.
[15] This shows the highest number of tokens among following stressed syllables where /t/ deletion occurs.

7.4. Style-shifting

The fourth most favoring predictor which surfaced in the mixed-effects logistic 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*) (Ciancia, forthcoming), 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.

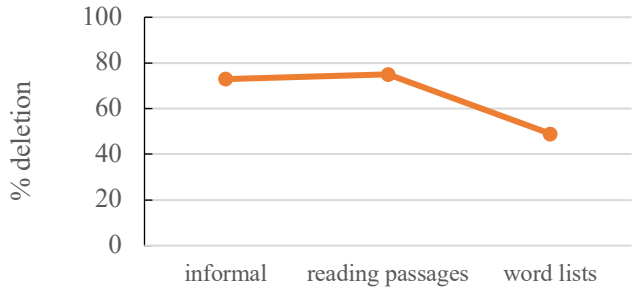

Figure 7
Probability of deletion in the C(C)t linguistic context, across style.

Along this line, it should not be surprising to find word lists disfavouring deletion (and thus favouring glottaling). 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.

7.5. Sex

The fourth statistically significant predictor, and probably the most salient as a sociolinguistic explanatory factor, is sex. Figure 8 illustrates that females adopt glottal variants more than males, whilst males delete /t/ more than females. 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 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*).

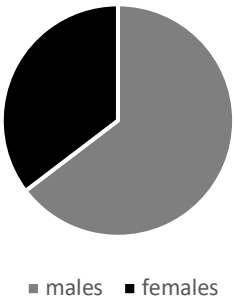

Figure 8
Probability of deletion by sex of participants.

A closer inspection shows that this trend also holds across different speech styles (see Figure 9).

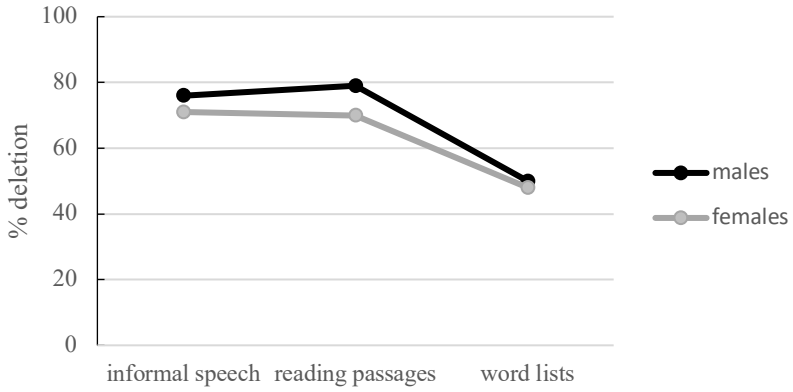

Figure 9
Rates of deletion by style and sex.

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.

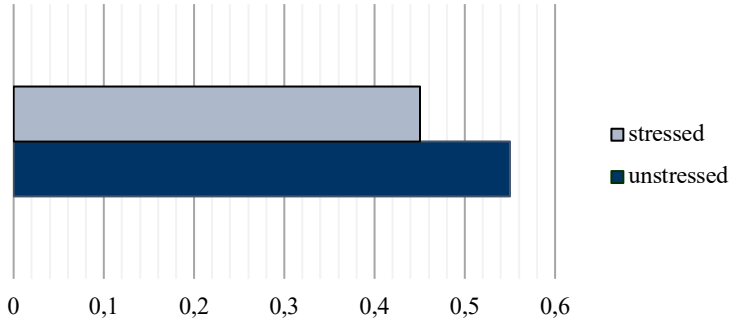

Figure 10
Probability of deletion by syllable stress.

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."

8. Conclusions

This 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, p. 106), it would be interesting to observe whether the application of the "Straight Deletion" formula (Rickford *et al.* 1991, p. 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, p. 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 valuable for sociolinguistic reconstruction tasks.

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