Reconsidering the variable context

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A phonological argument for (t) and (d) deletion

1. Introduction

Final consonant cluster simplification, or what variationists have traditionally labelled (t, d)-deletion, remains one of the most well studied variables in the analysis of English (e.g. Labov, 2001: 13). In this body of work, (t, d)-deletion refers to the process whereby /t/ or /d/ can be omitted in word final Ct or Cd coda clusters (e.g. *last, mind*). However, despite the attention paid to this feature of connected speech, very little (if any) focus has been dedicated to the complementary distribution of the coronal stops /t/ and /d/ in monomorphemic final clusters, as well as other phonological influences, such as the effect of intonational boundaries (IBs) on deletion patterns. This has led to a consistent practice of analysing (t, d) as a single linguistic variable, instead of considering the value of their separation, based on both sound linguistic reasoning and empirical evidence. After a brief review of current literature on multivariate analyses of (t, d)-deletion, this paper presents a socio-phonologically oriented research design that has been used to gather data from a peripheral southeastern variety of English. We martial these data to illustrate how (t) and (d) can be modelled as distinct dependent variables that are sensitive to particular factor groups: we focus in particular on the role of IBs in the deletion process.

2. Previous work

A large proportion of existing research considering the deletion of /t/ and /d/ has centered on varieties of North American Englishes, which in particular focus on New York and Philadelphia English (e.g. Guy, 1980), African American English (e.g. Fasold, 1972; Wolfram and Fasold, 1974), Chicano English (e.g. Santa Ana, 1992, 1996) and Appalachian English (e.g. Hazen, 2011). In all cases so far surveyed, research has shown stop deletion to be sensitive to both internal- and

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Primarily, WYN JOHNSON would describe herself as a theoretical phonologist whose main pleasure is in analysing data sets, as obvious in her 1999 publication A Workbook in Phonology *a companion to her simultaneous* A Course in Phonology *both published by Blackwell. She has, however, published in related disciplines, and with sociolinguist David Britain developed socio-phonology, combining the interests of the sociolinguists in learning what occurs in real language with the phonologist's question 'why?' She has also taken an interest in child language acquisition and published a book* Patterns in Child Phonology *(EUP, 2010).*

external-linguistic constraints. Comparatively little research has taken place on other varieties of English: in Britain, seminal studies include Tagliamonte and Temple (2005) and Temple (2009). While deletion has been extensively studied in the aggregate, there is a surprising array of variation in methodological and analytical approaches. As a result, a range of disparate terminology for the phenomenon endures, reflecting, to a greater or lesser extent, these diverse approaches. Thus, the terms '(t, d)-' or 't/d deletion', 'coronal stop deletion', 'final consonant cluster simplification' and 'consonant cluster reduction' have all been used to refer to the deletion of /t/ and /d/ in word-final environments. However, despite the varied approaches to the study of stop deletion[1] when it appears as the final segment of a coda cluster, cross-study observations do show a number of consistencies concerning the probabilistic distribution of variation, and the conditioning factors favouring stop deletion. The most influential internal linguistic constraints are, namely: preceding and following phonological environments; the morphological status of the coronal segment, and the type of lexical item (e.g. weak vs. strong verb forms) undergoing consonant-final deletion.

Concerning phonological context, the influence of the following environment on the deletion or retention of /t/ and /d/ has been shown to be remarkably uniform across the varieties of English so far studied. It has been consistently observed that following pauses and vowels activate the deletion of the stops to a much lesser extent than following consonants (e.g. *spoken his last #*, *his last opinion*, *his last word*, respectively). The internal ordering of consonant types is subject to some variability, too. That having been said, it has generally been reported that following obstruents (e.g. /b, k/) are most likely to trigger deletion, followed by nasals (e.g. /n, m/), glides (i.e. /j, w/), and liquids (e.g. /l, ɹ/). While resyllabification can be advanced as an explanation for why following vowels allow for greater rates of retention (e.g. the coda /t/ in *last opinion* can become the onset of the following syllable, creating the sequence *las topinion*), it has also been used as a means of describing the patterns of variation in pre-consonantal contexts. For instance, Guy (1991) has argued that, as a means of describing stop deletion variation in pre-liquid contexts, it is necessary to consider the potential structure of the resulting onset. Even though Guy found that following liquids were the second highest deletion environment (second only to obstruents), a closer examination of this consonant type shows that a following /l/ prompts more deletion than a following /r/. His argument for this pattern is broadly that, while /t, d/ can resyllabify to create a legitimate complex onset in English with /r/ (e.g. *last rite* to *las trite*), this is not the case with /l/ (e.g. *last leg* to **las tleg*). We therefore observe important distributional differences in the segments that have not been adequately explored. Further, the situation becomes slightly less clear when considering the effects of the preceding phonological environment. Based on the results of previous work, as well as his own survey, Labov (1989) proposes a hierarchy of deletion based on type of preceding segment:

/s/ > stops > nasal > other fricatives > liquids

The proposed hierarchy is in keeping with many representations of variation patterns for the deletion of final Ct and Cd clusters in North American Englishes. However, Labov (1989) goes on to argue that preceding phonological environment has less influence on variation patterns in relation to other factors (such as following environment, as above). As a result, a number of other models have been proposed to account for the influence of preceding consonants, such as the similarity effects of the Obligatory Contour Principle (OCP) as presented by Guy and Boberg (1997), which holds that, the more phonological similarities there are between the segments in the final cluster, the more likely deletion will be to occur. Thus, regarding Labov's hierarchy, /s/ shares both distinctive features of [+CORONAL] and [-SONORANT] with /t/ and /d/, while liquids

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share only [+CORONAL], thus suggesting that s-clusters prompt more deletion. However, this model is demonstrably unreliable, as it cannot predict subtleties within groups of consonants that share similar distinctive features (e.g. fricatives, such as /z/, will also share two features – for a discussion, see Tagliamonte & Temple, 2005: 283).

The third major predictor of deletion that has been considered in previous work is the morphological status of the final /t/ and /d/ segment (e.g. whether or not the segment holds syntactic value as a past tense marker). A general trend that can be identified from the literature is that the final coronal stop in monomorphemic (uninflected) words is more susceptible to deletion when compared with those which function as a regular past tense marker (e.g. in *passed* and *seemed*). For instance, in exploiting data from Appalachian English, Hazen (2011) demonstrates morphological effects using the four-way division of: monomorphemic non-verbs; bimorphemic adjectives; semi-weak verbs and monomorphemic verbs; and bi-morphemic verbs (which is presented as a hierarchy of most deletion to least deletion). In so doing, Hazen demonstrates a correlation between deletion or retention and morphological type. However, while morphological patterns have been found in varieties of English in the U.S., this has not been robustly demonstrated in varieties of British English. For instance, Tagliamonte and Temple (2005) observe no statistically significant effects in their York corpus for morphological status as a predictor. However, what remains unclear is whether or not such effects change significantly were (t) and (d) to be modelled independently in multivariate analysis.

As noted above, the primary aim for this paper is to establish the validity of separating (t) and (d) as discrete dependent variables. This approach has been suggested by Pavlík (2017) who, through an analysis of BBC radio bulletins, concludes that the separation of /t/ and /d/ can provide contrasting and much more nuanced results. While Pavlík's data demonstrate that following environment is still the most significant predictor overall in terms of a constraints hierarchy, other constraints can vary widely in their effects. For example, while preceding segments were found to affect the retention rates of (d), this was not the case for (t) (2017: 26). There are compatibility issues, however, with the data gathered and examined by Pavlík, primarily due to the scope of data representing morpheme final /t/ and /d/, and not simply word final /t/ and /d/. Thus, tokens such as *directly* (direct#ly) and *landlord* (land#lord) are included in the same multivariate analysis (2017: 5), which opens up the methodology to confounds, in that, potentially contrasting linguistic environments are subsumed under the same analytical category. In addition, while previous work on deletion has focused on data from natural conversation and sociolinguistic interviews, the use of radio bulletins provides a much more formal and intonationally unnatural style of speech. This is confirmed by Pavlík's note that, when justifying the inclusion of tokens in the sequence of Ct#t or Cd#d, word final /t/ or /d/ is not categorically lost, and the highly frequent token *and* does not categorically delete. Indeed, Pavlík uses the latter to remind readers 'that T/D deletion in scripted formal style does not behave identically to that found in informal unscripted speech' (2017: 8). Finally, while Pavlík does separate the analysis of these coronal stops, an approach that we advocate here, the rationale is driven by considerations of data first (rather than theory), namely, that there are 'holes' in the frequency of distribution across some contexts. For example, while bdC is infrequent, ptC is frequent, and that some highly frequent words belong to just one category (such as *and* belonging to (d)) (2017: 5). In contrast, above, we have departed with a foundational linguistic rationale for modelling (t) and (d) independently, and we lean on phonological argumentation to justify our research design.

3. Research design

The data under analysis come from the Mersea Island Corpus (MIC) (Amos, 2011). Mersea Island is situated off the coast of north east Essex, between the estuaries of the River Colne and the River Blackwater and, at its highest point, sits only 21 metres above sea level (see Figure 1). While the eastern side of the island remains largely agricultural, the western side has seen a rapid rise in its population, from approximately 3,000 inhabitants in the 1961 census, to over 7,000 in the 2011 census.

The MIC holds a number of advantages for the investigation of variable stop deletion. First, the corpus is novel in that the data come from an insular non-urban variety, *contra* the typical urban varieties that have dominated variationist studies on stop deletion. Unlike the sorts of urban English studies cited above, Mersea Island English is a comparatively low-contact variety (see Amos, 2011 for a discussion on demography and community development) and, as such, it is also predominantly monoethnic; Mersea Island is much more

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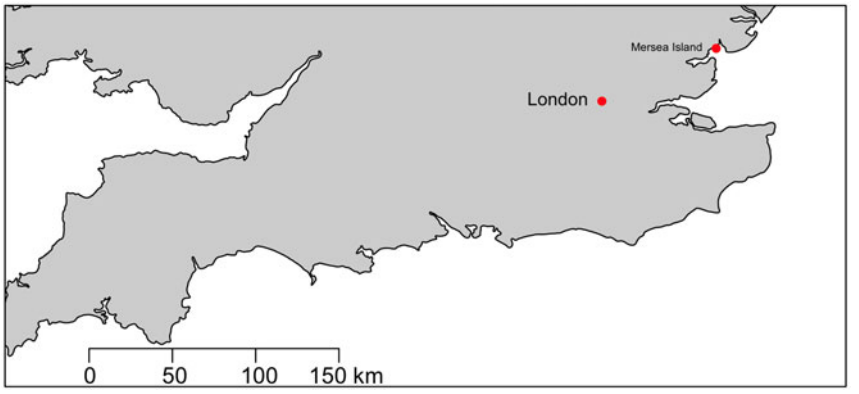

Figure 1. Mersea Island, southern England

socially homogeneous than the neighbouring county of Essex, for instance, which has also been the focus of recent work (e.g. Cheshire et al., 2015). In addition, as the lead author is a community insider, the research participants in the final judgement sample were known to the researcher. This helps mitigate a number of common methodological concerns pertaining to participants' engagement in interviews, such as the observer's paradox etc. It should also be noted that all participants selected for this study are monolingual Islanders, native to western Mersea, and all interviews – which were orientated around the elicitation of a casual speech style – took place in the participants' own homes.

The participant sample comprises 8 speakers, balanced for age and gender across two age groups (Table 1).

While the sample is small by comparison with traditional variationist studies, the two primary concerns of this paper are (a) testing the validity of separating (t) and (d) as distinct variables in non-scripted speech, and (b) establishing what other phonological processes might be operating on deletion variation that have not yet been considered. However, age and gender were nonetheless included as social factors in the analysis. We acknowledge the limitations imposed by such a small sample size on any generalisations that can be drawn, but we do stress that this article acts as a proof of concept for future research.

Table 1: Final sample

	19–24	60–75
Male	2	2
Female	2	2

Tokens of word-final /t/ and /d/ were extracted from all interview conditions, and were manually coded for a battery of factor groups, as per previous studies. Internal factors included:

- preceding and following phonological environment (obstruents, nasals, glides, liquids, vowels, and pauses)
- morpheme type and inflectional status (free and bound morphemes)
- word class (uninflected monomorphemes, regular weak verbs, irregular semi weak verbs, irregular strong verbs, regular adjectival forms, irregular adjectival forms)

In addition, the research design also includes intonational boundaries as a factor group in the analysis. A number of phonological processes can be blocked by particular prosodic units. An example of this is the assimilation of a coronal nasal /n/ to the place of the following consonant. This process will occur within a phonological word and across word boundaries in a phonological phrase (for example, *engage* and *ten gauge,* respectively), but will be blocked at an intonational boundary and, by extension, a phonological utterance boundary (for example, *I'm on the train, front carriage* and *I'm on the train*. *Fridays are crazy*, respectively). We contend that such processes will have an impact on the probabilistic distribution of stop deletion in word-internal clusters, since any /t/ or /d/ in this context would be within a phonological word (e.g. *grandfather*, *Christmas*), and would provide a valid argument for observations in the literature which suggest that a following pause correlates with higher rates of retention (as mentioned above), since many IP and PU boundaries will

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correspond with short breaks in the utterance. Therefore, IBs were included to address the working hypothesis (H^1) that deletion is correlated with the coronal stops' position in an intonational contour. Here, IBs were coded as a binary factor group comprising two levels: medial and final position (for example, as in (a) and (b) below).

a) That was the *last* film I saw (Medial)
b) He saw my keys *last* (Final)

Not all tokens of stop deletion were included in the final statistical analysis. For example, due to the high frequency and largely unstressed nature of 'and', leading to almost categorical deletion levels, these tokens were omitted from consideration.[2] In addition, all final /nt/ and /lt/ clusters were also excluded from the analysis. These clusters have hitherto been included in many deletion studies even though the /t/ in each case will be subject to glottalisation, which, we would contend, represents a case of lenition rather than deletion, especially in British English, and, as such, is a separate phenomenon (for further discussions related to glottalisation, see Temple, 2009). The remaining 897 tokens for (t) and (d) were subjected to multivariate analysis (/t/ $n_1 = 491$, /d/ $n_2 = 406$). Two mixed effects logistic regression models were built in Rbrul (Johnson, 2009) on (t) and (d) separately as dependent nominal variables, with SPEAKER as a random intercept. Word frequency was not considered as an interacting factor given the small token count, and WORD was not included as a mixed effect: modelling both WORD and SPEAKER as random intercepts in the same model leads to model convergence issues with logistic regression. The authors acknowledge the shortcomings of these methodological decisions here in any conclusions drawn from the data. In each case, best models are outlined and discussed below.

4. Results and discussion

First, we observe in the MIC an overall deletion rate of 58.3%, which is considerably higher than has been reported in other variationist studies on British English: e.g Tagliamonte & Temple report a 24% overall deletion rate for their York study (2005: 287). However, this does not imply a difference in grammars. Basing their assertions on Guy (1980), Tagliamonte and Temple (2005: 288) highlight that overall deletion rates are much less important than the variable effects of the conditioning factors, which we turn to next, and how these may compare against studies on other varieties.

An examination of the distribution of (t) and (d) independently reveals a difference in deletion behaviour. In all, 67.8% of (t) tokens were deleted, compared with 46.8% of (d) tokens ($n_1 = 333$ and $n_2 = 190$, respectively: a statistically significant distribution, Fisher's exact two-tailed test $p < 0.001$). Both internal- and external-linguistic factors (as outlined above) were included in the two models and, for both variables, no social factor (i.e. AGE, GENDER) were selected as statistically significant. In addition, for both variables, neither morpheme type nor word type showed significant effects. Indeed, this observation reaffirms the pattern found in previous work on British English (e.g. Tagliamonte & Temple, 2005), where no statistically significant effect for morpheme type is reported (*contra* much of the literature on North American Englishes). We do, however, observe important significant effects for phonological environment. While the two significant factor groups selected favouring (t)-deletion were FOLLOWING CONTEXT and INTONATIONAL BOUNDARY, in the modelling of (d) independently we observe FOLLOWING CONTEXT and PRECEDING CONTEXT as significant conditioning factors. In short, we observe that the linguistic factors predicting (t) and (d)-deletion are not operating in parallel (see Table 2).

The results presented in Table 2 are significant in that (a) they highlight very different distributions for the variables (t) and (d) when modelled independently, and (b) they illustrate that there is variation within the factor group selected a significant in both cases – FOLLOWING CONTEXT. As the table shows, following obstruents favour deletion for both variables, which accords with the literature. However, within this group, there is variation with the ordering of, for example, following liquids with regards to each variable. Possible explanations relating to resyllabification cannot help explain this contrast since both /tr/ and /dr/ are acceptable sequences, while */tl/ and */dl/ are not within English phonology. In addition, we find contrasting behaviour in the ranking of following pause and following vowels. The higher ranking, and, thus, statistical influence that a following pause has in the deletion and retention of /t/, while not unattested in previous literature (see Tagliamonte, 2012: 179–187), could be related to the selection of INTONATIONAL BOUNDARY as another significant factor group for this variable, and, as such, encourages further research in this area as this phonological factor has hitherto not been incorporated in stop-deletion research.

Regarding preceding environment, although no morphological effects were found to be

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Table 2: Mixed-effects logistic regression models for (t) and (d): contribution of factors selected as significant to the probability of /t/ and /d/ deletion, with best-fit models

/t/					/d/				
Input: 0.525	Total N: 491		R^2: 0.588		Input: 0.209	Total N: 406		R^2: 564	
	logodds	*N*	*%*	*Factor weight*		*logodds*	*N*	*%*	*Factor weight*
Following context					*Following context*				
Obstruent	1.807	251	51	0.859	*Obstruent*	1.629	189	47	0.836
Nasal	1.729	34	7	0.849	*Liquid*	1.177	8	2	0.764
Glide	0.969	50	10	0.725	*Glide*	1.007	30	7	0.732
Liquid	0.215	19	4	0.554	*Vowel*	−1.345	120	30	0.207
Pause	−1.475	35	7	0.186	*Pause*	−2.468	59	15	0.078
Vowel	−3.246	102	21	0.037	*p < .001*			*Range:*	75.8
p < .001			*Range:*	82					
Intonation boundary					*Preceding context*				
Medial	0.716	445	91	0.672	*Nasal*	*1.440*	*287*	*71*	*0.809*
Final	−0.716	46	9	0.328	*Sibilant*	*0.811*	*53*	*13*	*0.692*
p = .02			*Range:*	34.4	*Stop*	*−0.328*	*12*	*3*	*0.419*
					Liquid	*−1.923*	*54*	*13*	*0.128*
					p < .001			*Range:*	68.1
Best model: SPEAKER as random intercept + Following context (2.96e-66) + Intonation boundary (0.0211).					Best model: SPEAKER as random intercept + Following context (4.4e-33) + Preceding context (6.16e-13).				

statistically significant, the selection of preceding environment as a significant factor for (d) and not (t) once again highlights the contrasting behaviour of these variables in terms of underlying phonological conditioning.[3] It has been noted above that, regarding preceding environments, certain predictions can be made regarding deletion or retention – through, for example, distinctive features (Guy & Boyd, 1990), or collation of generalised data (Labov, 1989). However, by considering /t/ and /d/ together in models like these, we end up conflating two distinct distributional patterns. One way to illustrate this is through the distribution of /t/ and /d/ in monomorphemes. In these uninflected words we see that the phoneme /t/ has a wider range of possible final-cluster combinations than its voiced counterpart. Indeed, while /d/ is restricted to appear after the coronal nasal /n/ and the lateral /l/ (e.g. *band* and *told*), /t/ can appear following the segments /s, f, p, k/ (e.g. *past*, *left*, *apt*, *act*) in addition to /n, l/, the two environments in British English which prompt glottalisation reflexes in /t/ clusters.

The implications that this distribution has on any hierarchy of deletion, which is constructed as an integrated (t, d) model, is that a number of environments presented will only apply to one stop or the other. For example, in the hierarchy proposed by Labov (1989), preceding /s/ will only apply to the variable (t), while the category of 'nasal' will only apply to (d). Indeed, the restricted nature of /d/ across monomorphemes compared to that of /t/ (the latter having far greater restrictions when functioning as a bound morpheme) could be said to intersect with the correlation of preceding environment not being selected as a significant factor for /t/, especially when we also acknowledge the lack of significance carried by morphological category. Contrasts in the phonological distribution patterns can also account for the uneven distribution of the variables and 'holes in the data' which Pavlík (2017: 5) notes in his study (and uses to validate the separation of the coronals *post hoc*).

5. Conclusion

The results outlined here of (t)- and (d)-deletion in a small sample of Mersea English speakers suggest that we have two dependent variables with disparate probabilistic distributions. This finding reaffirms the initial claims made by this paper with regards to the separation of the coronal stops in sociolinguistic investigations. The data show, in line with previous British English studies, that morphological and external factors have little significant influence on the variation of either variable, and that it is the domain of phonology which carries primacy as an effect on retention and deletion patterns. In particular, we were able to evidence in our dataset that H^1 holds: IBs can and do show significant effects as a predictor on stop deletion (for /t/ and not /d/). The paper therefore highlights a new and viable constraint for deletion exploration: the position of the variable in relation to the intonational boundary. We have seen that (t) and (d) react differently to their place within the intonational contour and, as a result, we believe a more in-depth analysis of how this factor interacts with other constraints would elucidate the internal mechanisms governing stop deletion. The situating of this variable feature within the domain of phonology is perhaps not surprising when we consider the regulation of consonant clusters itself is within the domain of segmental phonology, with language or, indeed, dialect specific phonotactic constraints determining the overall structure of syllables.

In accordance with the previous literature outlined above, we have seen that following context is, once again, a highly significant factor in whether the speaker retains or deletes the coronal stops, with following obstruents least likely to retain either /t/ or /d/ . However, when the data are separated according to variable and type of following environment, we see variation, with the coronal stops behaving differently according to following sonorants, as well as the relative ordering of a following pause or vowel. This provides the basis for future quantitative and qualitative analysis, especially when considered in light of potential prosodic interactions.

The interaction of preceding environment was also highlighted as a significant factor. However, this was only significant regarding variation of (d). It was discussed earlier how the distribution of these stops is uneven across the range of preceding environments (for example, due to the phonotactic alignment of voicing assimilations in past tensed suffixes, and the interaction of additional lenition processes like glottalisation). This theoretical observation would, therefore, be motivation enough to treat (t) and (d) as separate variables, especially when constructing generalised hierarchies of deletion and retention, but we see this also vindicated in the behaviour of the data.

Notes

1 An umbrella label that we use throughout.

2 Indeed, following from these considerations, it could be argued that 'and' should be treated as an analytical unit in its own right (see e.g. Tagliamonte, 2012; Guy, 2014).

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3 We note that, having run a separate model for (t) and (d) together as one dependent variable, we observed a very similar constraints hierarchy to that documented by Tagliamonte and Temple (2005: 293), i.e. both FOLLOWING and PRECEDING contexts were selected as significant with an analogous ordering of factor groups and levels. In other words, the data presented here are not fundamentally distinct: when compared with other studies, they are similarly constituted and conditioned in the aggregate, but that running (t) and (d) separately indicates disparate probabilistic distributions.

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