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SQUIB

Searching for homophony avoidance in English coronal stop deletion

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Abstract

It is well-known that English variable word-final coronal stop deletion (CSD) is less likely to occur when the final coronal stop instantiates the inflectional suffix *-ed*. It is sometimes hypothesised that the reason for this effect is to avoid the homophony between past and present tenses that would result from the suffix *-ed* being deleted. This reasoning suggests another hypothesis: that CSD should also be disfavoured when it would create homophony between two distinct lexical items, such as *bald* and *ball*. In this squib, we test that hypothesis on data from a corpus of Philadelphia English. We find no evidence that probability of CSD is affected by homophony avoidance between lexical items. This weakens the case that homophony avoidance is at play in disfavouring CSD in the *-ed* case, and may have implications for the theory of homophony avoidance in phonology in general.

Contents

1. Introduction

Synchronic phonological processes often result in homophony: two forms with distinct underlying phonological representations are rendered (nearly) identical in production. For instance, in American English, both voiced and voiceless alveolar stops become a flap [ɾ] when intervocalic in certain prosodic contexts. The result is that words like *patting* and *padding*, underlyingly /pætɪŋ/ and /pædɪŋ/, are indistinguishable in production as [pʰæɾɪŋ]. In cases like this, the phonological rules of the language obstruct communication by making it harder for the listener to determine which underlying form was intended by the speaker; if the phonological rule were suspended, the speaker's meaning would be more effectively communicated.

Several studies have found such homophony-avoidance effects: that is, the suspension of a phonological rule whose application would result in homophony. Crosswhite (1999) found that unstressed-vowel reduction in Trigrad Bulgarian is blocked when reduction would make the singular form of a noun identical to its plural, or the nominative identical to the accusative; Munteanu (2021) shows that a similar effect in Russian is synchronically productive. Crosswhite suggests that such homophony-avoidance effects can only occur within the morphological paradigm – that is, the homophony that is avoided must be between different inflected forms of the same root. Kaplan & Muratani (2015) propose that this is true for *categorical* phonological processes, but that *variable* phonological processes may show quantitative effects of homophony avoidance across paradigms, in that a variable process may be systematically less likely to apply to lexical items for which the output of the process is homophonous with a different lexical item. This hypothesis is supported by their finding of inter-paradigmatic homophony-avoidance effects in a variable contraction process in Japanese, but to the best of our knowledge has not been tested outside of Japanese. In this squib, we search for inter-paradigmatic homophony-avoidance effects in a variable process in English.

English coronal stop deletion (CSD) is among the most thoroughly studied of variable phonological processes. CSD involves the optional deletion of a word-final coronal stop, /t/ or /d/, when preceded by a consonant, so (for example) the word *wrist* /ɹɪst/ might be realised as [ɹɪs]. One widely studied property of CSD is an effect of morphological structure on a word's likelihood of undergoing CSD: monomorphemic words such as *mist* are more likely to exhibit CSD than words in which the final stop constitutes the regular past-tense suffix, such as *missed*. This morphological pattern has been reported in many studies of CSD in a wide range of varieties of English (Labov *et al.* 1968; Guy 1991; Baranowski & Turton 2020; MacKenzie & Tamminga 2021, *inter alia*).

One influential hypothesis about the morphological effect on CSD, often referred to as the *functional* explanation, is that it is an intra-paradigmatic homophony-avoidance effect. According to the functional hypothesis, regular past tenses are less likely to undergo CSD because CSD leaves a regular past tense such as *missed* indistinguishable from the infinitive or present-tense *miss*. The probability of CSD, on this account, is reduced in this situation in order to reduce the risk of ambiguity regarding what inflectional form of the word is intended (Kiparsky 1972; Guy 1996). An alternative to the functional hypothesis appeals to deletion applying multiple times across morphological levels within lexical phonology (Guy 1991), but it is not our goal here to compare competing hypotheses for the morphological effect.

Most studies reporting on the morphological effect have divided words potentially subject to CSD into two or three morphological categories: monomorphemes, regular inflected forms in *-ed*, and sometimes irregular 'semiweak' inflected forms like *kept*. MacKenzie & Tamminga (2021) unpack these into a wider range of morphological categories, distinguishing past tenses in *-ed* from participial functions of the *-ed* suffix, and distinguishing monomorphemes from polymorphemic words whose final coronal stops do not represent the *-ed* suffix. The results of their more fine-grained analyses pose difficulties for several theoretical accounts of the morphological effect on CSD. For example, they find that attributive passive participles (as in *the* ***trapped*** *miners*) undergo CSD at a higher rate than eventive passives (as in *the miners were suddenly* ***trapped*** *by an explosion*), a pattern they argue is potentially contrary to the predictions of the functional hypothesis. A similar potential challenge to the functional hypothesis comes from failed attempts to find a difference between participles (which have a disambiguating auxiliary) and preterites (Labov 1994; Guy 1996).

MacKenzie & Tamminga (2021) note that, since the functional hypothesis is based on the premise that CSD will be less likely where it would give rise to ambiguity, it makes other predictions that have not yet been tested. One such prediction is that there might also be an inter-paradigmatic homophony-avoidance effect: that is, words that become confusable with a different word when CSD is applied should disfavour deletion. For example, *bald* and *chest* become homophones for *ball* and *chess* when the final coronal stops are deleted; a functional model predicts that CSD should be less likely for these words than for words like *rest* and *sound*, which remain unambiguous when their final stops are deleted. This squib aims to test that hypothesis: are words that are made homophonous with other words by CSD less likely to undergo CSD? This hypothesis bears upon both the debate regarding the cause of CSD's morphological pattern, and the hypothesis of Kaplan & Muratani (2015) that inter-paradigmatic homophony avoidance may be found as a constraint on variable phonological processes. It is also pertinent to a long tradition of investigating how homophony avoidance might play a role in sound change (e.g., Blevins & Wedel 2009; Mondon 2009; Wedel *et al.* 2019), despite the apparent diachronic stability of CSD in modern American English.

2. Data and analysis

We investigate this question in a subset of the CSD data set used by MacKenzie & Tamminga (2021), derived from interviews with white adult English speakers from the Philadelphia Neighborhood Corpus (Labov & Rosenfelder 2011). For the first analysis, we extracted all tokens of monosyllabic lexical items coded by MacKenzie & Tamminga as 'true monomorphemes', excluding *-ed* inflected forms as well as a few monosyllabic bimorphemes such as *joint*. We focus on monomorphemes to avoid the confounds introduced by morphologically complex words; for example, CSD in regular past-tense forms always results in the present-tense stem (which is of course the pattern that the functional explanation of CSD was originally directed at), meaning we can't separate the causal role of homophony avoidance in those words from competitor accounts implicating the sensitivity of CSD to morpheme boundaries (Guy 1991). We focus on monosyllables because it is easier to unambiguously decide whether or not a monosyllable has a lexical homophone. This produced a total of 129 lexical items, given in the Appendix.

We coded these 129 lexical items for whether or not CSD generates a homophone of another word (such as *bald* → *ball*); each author coded half of the word list and then their work was checked on a second pass by the other author. In most cases, it was easy to determine the existence of a homophone based on our own vocabularies as native speakers of English and our familiarity with the Philadelphia dialect as sociolinguists. Proper names were considered potential homophones; for instance, *jest* and *melt* were coded as having homophones (*Jess* and *Mel*). We only considered underlying forms as possible homophone competitors. In total, 50 of the 129 monosyllabic monomorphemic lexical items were coded as having homophones, and only four were identified as problematic to code for one reason or another: *aunt* (which has two common pronunciations, only one of which has a homophone); *land* and *mint* (whose homophones are abbreviations for *local area network* and *minimum*); and *kind* (whose homophone *kine* is arguably obsolete). After excluding those four lexical items, we had 3,224 tokens of monosyllabic monomorphemes, of which 1,470 represented lexical items that have homophones under CSD. The overall deletion rate was 46%.

Apart from the existence of homophones, the data were coded for several control predictors, following the decisions made by MacKenzie & Tamminga (2021). The segment preceding the target coronal stop was coded as /l/, /n/, or obstruent. The segment following the target coronal stop was coded as pause, vowel, consonant permitting resyllabification of the /t, d/ as an onset, or consonant not permitting such resyllabification. Lexical frequency was coded using the Subtlex-US (Brysbaert & New 2009) Lg10CD measure of the word form, *z*-scored.[1] The local speech rate is operationalised as the number of vowels per second in a 7-word window around the token, *z*-scored within speaker. We also added a control predictor for whether or not the target coronal stop matched the preceding consonant in voicing. All data manipulation was done using the Tidyverse (version 1.3.1, Wickham *et al.* 2019) in R version 4.1.1 (R Core Team 2021). Mixed-effects regression models were estimated using the `lme4` package (version 1.1-29, Bates *et al.* 2015). The control predictors just described were included as fixed effects in all models, along with random intercepts for speaker and lexical item. All categorical predictors are sum-coded. Model coefficients represent the predictors' effects on the log-odds of deletion.

[1] Anonymous reviewers suggested also including lexical frequency of the target homophone. This quantity is only defined when a homophone exists; a regression model limited to words for which a homophone does exist found no effect of homophone frequency.

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3. Results

Table 1 gives the output of the model from the first analysis as described. It corroborates previously documented effects on CSD of factors such as following segment (Guy 1980) and speech rate (Guy *et al.* 2008); the predicted effect of homophony avoidance is not significant (β = −0.03, $p = 0.79$).

We then considered the possibility that restricting the scope of the analysis might be making it harder to detect homophony-avoidance effects, if it narrows the range of lexical diversity in the data. We therefore conducted a series of additional analyses in which we made different decisions on various points. For each of these subsequent analyses, we report in Table 2 only the *N*, estimated coefficient, and *p*-value for the effect of the 'Deleted form has homophone: yes' predictor. The other predictors in the model stay the same as in Analysis 1 except where described below. Table 2 also gives the raw deletion rates by homophone status in each data set.

In Analysis 2, we added polysyllabic words to the data being considered in the analysis, but still limited the data to true monomorphemes and limited the definition of a homophone to a single existing word. Only three polysyllabic words in the data were coded as having potential homophones: *locust*, *talent* and *warrant*. Because the number of syllables is itself a possible conditioning factor on CSD, we also introduced another control predictor from MacKenzie & Tamminga (2021), combining syllable

Table 1. *Results of mixed-effects logistic regression predicting deletion in monosyllabic monomorphemes (Analysis 1). N = 3,224. Reference levels: preceding obstruent, following vowel, heterovoiced cluster. By-word random intercept variance* = 0.36*; by-subject random intercept variance* = 0.33.

Predictor	β	*z*	*p*
Intercept	−0.28	−1.88	0.06
Preceding segment: /l/	−0.23	−1.41	0.16
Preceding segment: /n/	0.24	1.76	0.08
Following segment: non-syllabifiable consonant	1.09	13.97	<0.001
Following segment: syllabifiable consonant	−0.04	−0.43	0.66
Following segment: pause	−0.38	−4.87	<0.001
Homovoiced cluster: no	−0.11	−0.89	0.37
Within-speaker speech rate	0.16	3.60	<0.001
Z-scored frequency (Lg10CD)	0.13	1.60	0.11
Deleted form has homophone: yes	**−0.03**	**−0.26**	**0.79**

Table 2. *Estimated effect of 'Deleted form has homophone: yes' predictor in four analyses over different data subsets and homophony definitions. Analysis 1 is repeated from Table 1.*

						Deletion rate	
Analysis	Data included	Homophone def.	*N*	β	*p*	With homophone	Without
1	Monosyllabic, true monomorph.	Single word	3,224	−0.03	0.79	45%	48%
2	Any # syllables, true monomorph.	Single word	4,973	0.10	0.63	57%	45%
3	Any # syllables, true monomorph.	Any combination of words	5,039	0.06	0.74	57%	45%
4	Any # syllables, any non-*ed* form	Any combination of words	7,787	−0.004	0.98	56%	49%

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count and stress information: monosyllabic, polysyllabic with final stress and polysyllabic with non-final stress.

In Analysis 3, we used the same subset of data as in Analysis 2, but expanded what counted as a possible homophone. In Analysis 2, we considered only single-word homophones; for example, the word *attract* does not have a single-word homophone after deletion (**attrack*), and thus was coded as not having a homophone in Analysis 2. However, it does have the potential for ambiguity with the two-word phrase *a track*. Analysis 3 therefore counts *attract* as 'having a homophone'. We did not attempt to distinguish between likely and unlikely phrases; any combination of real words that produces a homophonous sequence to the target word after deletion is counted. A total of 11 lexical items are added to the 'Deleted form has homophone: yes' category in this analysis.

Finally, in Analysis 4, we expanded the data subset once more to include all non-*ed* forms (see MacKenzie & Tamminga 2021 for details). That is, we added back in the morphologically complex forms, *except* those composed of a regular verb stem inflected with the -*ed* suffix. These include compounds (e.g., *playground*) as well as words with various non-*ed* suffixes and prefixes (e.g., *assistant*, *largest*, *psychologist*, *react*, etc.). An additional 15 lexical items were added to the 'Deleted form has homophone: yes' category; examples include *lowest* (*Lois*) and *regiment* (*regimen*).

Table 2 shows that at no point in the gradual expansion of our analyses does there emerge a significant effect of the deleted form having a homophone. The sign of the estimated coefficient also flips across different analyses; the $\beta = -0.03$ of Analysis 1 is at least in the predicted direction (having a homophone makes deletion less likely), but the coefficients in Analyses 2–3 are positive and thus reflect a (non-significant) effect of homophony increasing the likelihood of deletion. We could, of course, have corrected the *p*-values reported in Table 2 for multiple comparisons since we are doing multiple tests of essentially the same hypothesis. Given how high the *p*-values already are, however, it would be a superfluous exercise.

4. Discussion

Despite extended efforts, we did not find an effect of homophony avoidance in CSD. Of course, a failure to detect an effect is not equivalent to a demonstration that no such effect exists. However, in light of the very small coefficients of our homophony predictor across multiple analyses, compared to the much more robust effects of various known predictors, it seems worth considering why any pressure toward homophony avoidance, if it exists, is too weak to show up here. After all, some previous studies have been able to detect phonetic effects attributable to homophony avoidance in conversational speech (see Wedel *et al.* 2018 for examples). We can identify several potential reasons why homophony avoidance is not apparent in the context of non-complex CSD.

One factor that could obscure potential homophony-avoidance behaviour in CSD is external disambiguation. We did not take into account any aspect of sentence context or real-world context in disambiguating potential homophones. If homophony avoidance is fundamentally driven by ambiguity avoidance, the power of external context to disambiguate would mean that many instances where deletion would produce homophony do not produce true ambiguity and therefore would not inhibit deletion. Although Boland & Blodgett (2001) show that the role of context in disambiguating true homophones comes late in sentence processing, it is not well understood whether listener-oriented production behaviour accounts for such comprehension processes. Studies of variation in conversational speech that take contextual disambiguation into consideration are exceedingly rare (though cf. Poplack 1980). This is presumably due to how laborious and subjective it is to code every token in the data for its potential ambiguity in context from the transcript, in contrast to the much simpler task we undertook here of coding lexical types for the existence of competitors. Methodological considerations notwithstanding, it would be premature to conclude that CSD exhibits no homophony avoidance without zeroing in on the contexts in which the potential functional pressures are strongest.

A second consideration in interpreting our null results is that it remains unclear whether CSD is truly acoustically neutralising. Treating CSD as a binary choice between deletion and retention obscures

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acoustic (Temple 2014) and articulatory (Purse 2021) phonetic gradience in its production. Although the current data were coded such that any acoustic reflex of a coronal stop is counted as retention, it remains possible that a token of (e.g.) *bald* subject to CSD may be subtly acoustically different from *ball*, for example, in vowel duration (which we have not measured). It is an open question whether listeners could make use of those small differences for comprehension, or whether speakers would expect listeners to be able to do so. In other words, it is not certain whether CSD even produces homophony to a degree that is relevant to the issue of homophony avoidance. The relationship between perception and production in this domain is complex, and the answers are not likely to be available via introspection, careful listening, or inspection of the spectrogram. Our report of the basic production behaviour in conversational speech is a useful first step towards integrating questions about phonetic form and homophony avoidance in CSD.

Our failure to observe homophony avoidance in CSD might also be related to properties of CSD itself. For one thing, CSD occurs word-finally. Cross-linguistic work has suggested that the functional pressure toward ambiguity avoidance may be weaker in word endings than beginnings (Wedel *et al.* 2019). Moreover, CSD is a late-phonological phenomenon characteristic of connected speech. It could be the case that CSD is remote enough from the lexicon that competition with other lexical items is not a driving force in production decisions. Relatedly, CSD is not a phenomenon about which English speakers seem to have strong metalinguistic judgments. If there is any element of intention or awareness in homophony avoidance, we might expect it to play less of a role in a non-salient variable such as CSD. These properties make CSD quite different from the Japanese variable nasal contraction case discussed by Kaplan & Muratani (2015), which is word-medial, early in the phonology, and available for metalinguistic judgments. Future work might ask not *whether* but *when* and *why* homophony avoidance influences the production of intraspeaker variation. As we have gestured to here, different potential mechanisms for homophony avoidance might be expected to exert an influence on different kinds of variables or under different circumstances.

Finally, we ask whether our null result, insofar as it reflects a true lack of effect, has ramifications for competing accounts of CSD. While CSD has played a prominent role in arguments for functional effects in phonology (Kiparsky 1972), those arguments have been focused on the morphological conditioning of CSD probabilities. Does our failure to find homophony avoidance within the more limited context of monomorphemic CSD undermine the functional explanation for the morphological effect? We do think it could pose a challenge to that line of explanation. On a narrow level, some tentative hypotheses advanced above for why homophony avoidance is not in evidence in the current study – for example, that CSD might not produce true homophony – would seem to apply just as well in the *-ed* case as in the monomorphemic case. And more broadly, one of the appeals of functionalism is its general nature. If the truly explanatory force involved is that language users aim to prevent miscommunication by avoiding ambiguity, then we might expect ambiguity to be ambiguity, regardless of whether it is grammatical or lexical. If it turns out instead that ambiguity avoidance only applies to morphologically complex words within a morphological paradigm, it raises questions about the functional motivation for such avoidance. It also suggests that we would need a more elaborated model of how such functional pressures interact with the grammatical architecture. All of this is to say that a lack of homophony avoidance in monomorphemic CSD would limit the generality of the functional expectation, but does not rule it out definitively as a possible force shaping variation in morphologically complex words.

Appendix A. List of words included in Analysis 1, with homophone status and number of tokens included in the data set

Word	Has homophone?	Tokens
ACT	No	26
BALD	Yes	1
BAND	Yes	46
BELT	Yes	12
BEND	Yes	1
BIND	No	1
BLAND	No	1
BLAST	No	17
BLEND	No	2
BLIND	No	1
BLOND	No	1
BLONDE	No	4
BOND	No	5
BOUND	No	1
BRAND	Yes	5
BREAST	No	3
BRUNT	No	1
BUILD	Yes	23
BUST	Yes	2
CENT	No	1
CHEST	Yes	5
CHILD	No	90
CHRIST	No	5
COAST	No	8
COLD	Yes	24
COLT	Yes	1
COUNT	No	22
CRAFT	No	3
CREST	Yes	1
CRUST	No	6
CYST	Yes	2
DAFT	No	1
DRAFT	No	4
DRIFT	No	1
DUST	No	2
EAST	No	40
END	Yes	112
FACT	No	141
FAINT	Yes	2
FAST	No	50
FAULT	Yes	13
FEAST	No	5
FIELD	Yes	22
FIND	Yes	103

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Word	Has homophone?	Tokens
FIST	No	5
FOLD	Yes	2
FOND	No	3
FRIEND	No	138
FRONT	No	131
FROST	No	1
FUND	Yes	2
GHOST	No	7
GOLD	Yes	15
GRAND	No	9
GRANT	No	4
GRIND	No	2
GROUND	No	22
GRUNT	No	1
GUILD	Yes	1
GUILT	Yes	1
HAND	No	99
HOIST	No	1
HOLD	Yes	39
HOST	No	2
HUNT	Yes	2
JEST	Yes	1
LEND	Yes	2
LIFT	No	6
LIST	No	7
MELT	Yes	1
MIND	Yes	81
MOUNT	No	20
MUST	Yes	48
NEXT	Yes	113
OLD	No	447
PAINT	Yes	12
PAST	Yes	36
PASTE	Yes	2
PLANT	Yes	9
POINT	No	71
POST	No	5
POUND	No	11
PRIEST	No	27
PRINT	No	8
QUAINT	No	1
RENT	Yes	26
REST	No	57
ROAST	No	11
ROOST	No	1
ROUND	No	14
RUNT	Yes	1
SAINT	Yes	103

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Word	Has homophone?	Tokens
SALT	Yes	24
SAND	No	7
SCENT	No	1
SCRIPT	Yes	1
SCULPT	No	1
SEND	No	37
SHIELD	No	1
SHIFT	No	9
SLANT	No	1
SOFT	No	7
SOUND	No	17
SPEND	No	29
STAND	Yes	70
STRAND	No	2
STRICT	No	62
TASTE	No	5
TENT	Yes	2
TEST	Yes	28
TEXT	Yes	1
TOAST	No	1
TRUST	Yes	23
TWIST	No	5
VAST	No	1
VEST	No	1
WALT	Yes	2
WANT	Yes	254
WASTE	No	10
WEST	Yes	59
WILD	Yes	7
WIND	Yes	17
WORLD	Yes	110
WRIST	No	2
YEAST	No	2

Competing interests. The authors declare no competing interests.

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