

Cross-derivational feeding is epiphenomenal*

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Baković (2005, et seq.) analyses patterns of sufficiently-similar segment avoidance as the interaction of undominated agreement and anti-gemination constraints, a pattern known as *cross-derivational feeding* (CDF). A study of historical English shows that the bleeding interactions between epenthesis and assimilation which prevent adjacent sufficiently-similar segments can be explained by grammar-external constraints on parsing sound change in progress. Evidence against both of the strong predictions of CDF are presented.

1. Introduction

Languages often separate sequences of *sufficiently-similar segments* by a synchronic process of epenthesis. A textbook example of this pattern can be seen with phonologically-general allomorphs of the English regular preterite (and past participle) and noun plural (and the possessive, and 3sg. verb agreement) suffixes. These morphemes are assumed, following much prior work (e.g., Chomsky & Halle 1968: 210; Anderson 1973; Pinker & Prince 1988: 102; Baković 2005), to be underlying /-d/ and /-z/ respectively (the transcription here is broad, as raising before voiceless stops, and the flap formation which renders it opaque, are omitted; see Idsardi 2006).¹

| | /-d/ | | /-z/ | |
|--------|-----------------|-----------|------------------|-----------|
| (1) a. | næp- t | ‘napped’ | læp- s | ‘laps’ |
| b. | næb- d | ‘nabbed’ | læb- z | ‘labs’ |
| c. | sajt- əd | ‘sighted’ | li:s- əz | ‘leases’ |
| d. | sajd- əd | ‘sided’ | tʃi:z- əz | ‘cheeses’ |

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¹ If, however, the exponents are /-əd, -əz/, extrinsic ordering is a non-issue; see Miner 1975 and Borowsky 1986: 135. Since these isolated claims have not tarnished the status of these examples as the *Paradebeispiele* of bleeding, they are not considered further.

In a serial analysis, epenthesis in (1cd) occurs between segments which agree on major place features and continuancy (formalized after Reiss 2003).

- (2) EPENTHESIS: $\emptyset \rightarrow \text{ə} / \text{C}[+\text{OBS}]_1 \text{ — } \text{C}[+\text{OBS}]_2$
 $\forall F_i \in \{\text{LAB, COR, DOR, CONT}\} : [(\alpha F_i)_1] = [(\beta F_i)_2]$

Assimilation of voice occurs after epenthesis, which bleeds it.

- (3) ASSIMILATION: $[+\text{OBS}] \rightarrow [+\text{VOI}] / \left[\begin{array}{c} +\text{OBS} \\ +\text{VOI} \end{array} \right] \text{ — }$

Baković (2005, 2007, 2010) notes a potentially interesting fact concerning the above rules. To a first approximation, the one major feature irrelevant to the epenthesis rule in (3) is VOI, which is the very feature which is active in the rule of assimilation. Baković proposes that this is a generalization which the serial analysis has missed. However, this putative relationship between the irrelevance of voicing in terms of determining “sufficient similarity” and the assimilation of voice is easily expressed in the global evaluation entailed by Optimality Theory (OT). For Baković, sufficiently similar segments are disfavored by a constraint NOGEM, which is undominated in English; this is sufficient to generate epenthesis in *padded*. However, /td/ sequences, like the underlying form of *patted*, are not geminates *per se*; rather they would, counterfactually, be turned into geminates by the constraint forcing voice assimilation, AGREE(VOI). Both these constraints are undominated, a pattern known as *cross-derivational feeding* (CDF).

- (4) English CDF constraint ranking (to be revised):
 NOGEM, AGREE(VOI) \gg DEP(V), IDENT(VOI)

| | /pæt-d/ | NOGEM | AGR(VOI) | DEP(V) | ID(VOI) |
|--------|---------------|-------|----------|--------|---------|
| (5) a. | pæt d | | *! | | |
| b. | pæt: | *! | | | * |
| ↳ c. | pæt əd | | | * | |
| d. | pæt ət | | | * | *! |

The CDF account makes two predictions. First, as noted by Pająk & Baković (in press), any feature ignored for the identification of sufficiently similar segments assimilates, since an AGREE constraint targeting that feature must be undominated to generate CDF. Secondly, a counterbleeding interaction between assimilation and a process which avoids sufficiently similar segments

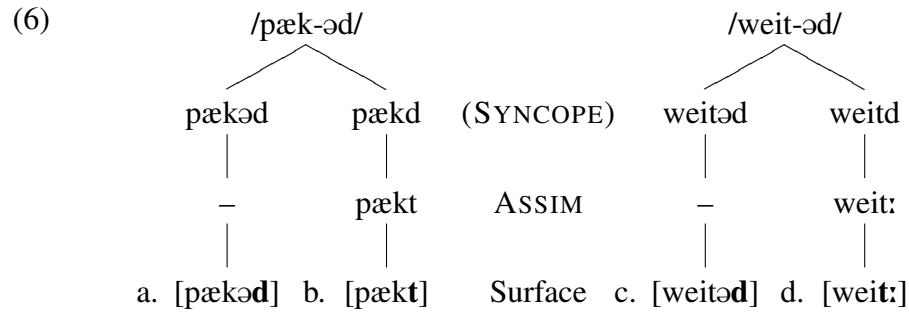
should be an impossible sound pattern (Baković 2007: 246). A candidate showing counterbleeding, like [pætət], is a “born loser”, since for a candidate which does not produce a sequence of sufficiently-similar segments, assimilation is a gratuitous violation of faithfulness.

This study attempts to evaluate the predictions and merits of CDF. In the next section, consideration of the historical context that brought about the Modern English pattern demonstrates that CDF emerges from a plausible constraint on parsing during acquisition. It is argued that it is not the case that sufficiently similar segments are disfavored synchronically: rather, they “underperform” in the sense that they are difficult for language learners to recover as tokens of affixation at all. §3–4 highlight problems that arise for the CDF analysis of Modern Standard English and of modern English dialects, respectively. §5–6 present evidence from Catalan and New Julfa Armenian, respectively, which provide counterexamples to the two predictions of CDF identified above. In §7, it is argued that data reported by Pająk & Baković (in press) necessitates that processes of epenthesis and assimilation in Polish be grammatically distinct, a separation explicitly denied by CDF. A final section (§8) concludes.

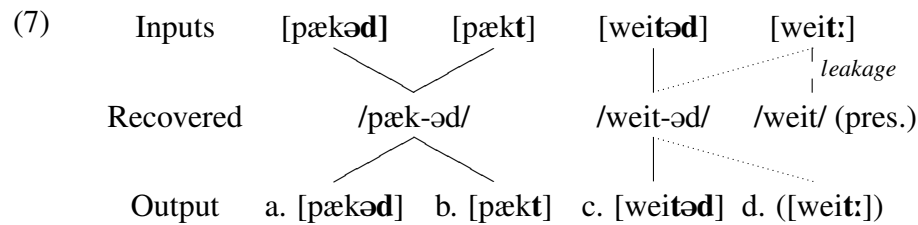
2. /-d, -z/ in the history of English

The process of epenthesis in Modern English is the result of a reanalysis of an older process of syncope. During the Old English period, sound change and the extension of the most productive past tense allomorph to the two less productive weak verb classes resulted in a single regular past, /-əd/ (Hare & Elman 1995; Yang 2005), and the plural /-əz/ was similarly generalized to all but a few nouns. Early in the Middle English period, a process of syncope targeting the unstressed /ə/s in these two suffixes was actuated. We assume that this rule was simultaneously activated in all contexts, and that in all contexts, the rate of application increased in parallel (e.g., Kroch 1989; Fruehwald et al. in press).² However, as we know, syncope between sequences of sibilants and alveolar stops, respectively, was ultimately inhibited. To see why, consider the derivation of two past tense verbs after the innovation of syncope is schematized in (6).

² For the written history of English, local voice assimilation has been an exceptionless, surface-true process, one which is fed or bled even by later-innovated processes. For this reason, it is assumed to be a surface filter, but this does not figure into the larger analysis; all that is crucial is that assimilation applies after syncope.



Note that (6d) produces a word-final geminate. We propose that the otherwise non-existent contrast between word-final geminates and singletons resulted in language learners misperceiving the novel category, i.e., geminates, as the basic category, i.e., singletons (cf. Blevins 2004: 54, which posits a similar principle, Structural Analogy). This is schematized for two generations of speakers below, with outputs of the first serving as the inputs to the second.



By this principle, some instances of the past tense of *wait* are misperceived as the bare form, not as instances of the syncope rule applying to the past tense. Even if one supposes that adults could recover some of the tokens of (7d) as affixed forms by the use of other local syntactic knowledge (such as agreement morphology), a survey of natural misunderstandings (Labov 2010: chap. 2) suggest that speakers are unable to reliably deploy their knowledge of the world to correct misunderstanding. Labov reports fifteen misunderstandings involving the pairs *copy* and *coffee*, and *Dawn* and *Don*, which were not ameliorated even though the target word was far more salient, or sensical, in the discourse.

What would speakers make of the low rate at which they perceive syncopated [weit:]? Indeed, would speakers' grammars track this fact at all? We assume, following a large body of work (Labov 1969; Cedergren & Sankoff 1974), that the rates at which variable phonological processes apply in different environments are a target for acquisition. Some of the most convincing evidence for this is given by a study of the pronunciation of *ing* as a coronal

nasal (i.e., [m]; this process is sometimes imprecisely called “g-dropping”). Labov (1989) shows that children approximate their parents’ probabilities this variable in different morphological environments with considerable precision by age seven. When such evidence has not simply been ignored, it has been objected to with an “argument from incredulity”, and claims that probabilities of variable processes are not learned, but rather can be accounted for by underspecification or non-ranking have been no more than promissory notes without empirical substance. Therefore, we claim that during acquisition, speakers tracking such probabilities would systematically *underestimate* the rate at which syncope applied in contexts where it produced final geminates. At the point of restructuring, learners projected the syncope rule into the underlying form of the past tense and noun plural, etc., morphemes, and simultaneously innovated a rule of epenthesis.³ The distribution of surface forms over time is schematized for the past tense (after Mondon 2009b: 36).

| | /t, d/-final stems | elsewhere |
|----------------------------|--------------------|------------|
| (8) Middle English | [-əd] | [-əd] |
| syncope (ə → ∅) | [-əd ~ -d] | [-əd ~ -d] |
| variation becomes lopsided | [-əd ≫ -d] | [-əd ≪ -d] |
| Modern Standard English | [-əd] | [-d] |

Jespersen (1942: 267) makes a similar suggestion: “The retention of the weak vowel in *-ses* as in *glasses*, etc., is a kind of reaction against the general tendency to drop it, due in the first place to the want of distinctiveness, as the two numbers would otherwise be identical.”⁴

³ We wish to remain agnostic about whether learners posited a more restricted syncope rule before the rule was inverted into a rule of epenthesis.

⁴ A lingering issue is the development of “zero” pasts, those verbs such as *bid* or *hit* which do not change in the past. Old English had a class of /Ct, Cd/-final stems which formed preterites in /-e/ (Moore & Knott 1919: 185). This vowel reduced (Jespersen 1948: 186), then was apocoped in Middle English (Jespersen 1942: 27f.). Modern reflexes of this class which maintain the zero past include *set*, *shut* and *spread*. However, the modern-day zero class includes several historically strong verbs, not to mention borrowings from Old Norse (e.g., *cast*), Norman French (e.g., *cost*), and Middle Dutch (e.g., *split*). This modern class contains only short-vowel stems (and this is also true of the *bend* class) whereas long-vowel stems ending in /-t, -d/ are either ablauting (e.g., *stride*), shortening (e.g., *read*), or simply regular with epenthesis. The homophony produced by (earlier) sound change was limited a lexically-conditioned subset of the phonological contexts where regular sound change would have generated homophony.

This leakage account is mechanistic and extragrammatical, and therefore is in stark contrast to grammatical accounts of homophony avoidance (e.g., Crosswhite 1999; see an assessment of this and similar work in Mondon 2009b); instead it supports a parsimonious phonological theory which distinguishes between tendencies emerging from cycles of acquisition and change, and those grammars which are computable (e.g., Ohala 1992, 1993; Buckley 1999; Blevins 2004, 2005; Cohn 2008; Hale & Reiss 2008).

3. /-z/ in Modern Standard English

This section considers a problem for the CDF analysis of the regular noun plural, etc., in Modern Standard English. There is epenthesis not only between /-z/ and stems ending in /-s, -z/, but also alveopalatal /ʃ, ʒ, tʃ, dʒ/.

- (9) a. dɪʃ-əz 'dishes'
b. ʒʌdʒ-əz 'judges'

Neither /ʃs/ nor /dʒz/ are geminate sequences, nor are the sufficiently similar by any assimilation process mentioned thus far, so NOGEM cannot be militating against them. Consider then the result of positing a high-ranked AGREE(ANTERIOR) constraint (IDENT constraints are omitted).

| | /dɪʃ-z/ | NOGEM | AGR(VOI) | AGR(ANT) | DEP |
|---------|---------|-------|----------|----------|-----|
| (10) a. | dɪʃz | | *! | * | |
| b. | dɪʃ: | *! | | | |
| c. | dɪʃs | | | *! | |
| ☞ d. | dɪʃəz | | | | * |

This is the only evidence for a high AGREE(ANTERIOR) constraint, as sequences of consonants differing only on subcoronal place do not in general occur inside the prosodic word. As for these sequences of coronal consonants disagreeing on sub-coronal place, a few phonological texts have claimed that there is sub-coronal place assimilation (Roach 1983:14; Lodge 1984: 2; Mohanan 1986:7). However, a host of experimental studies (Catford 1977: 223f.; Local 1992: 210f.; Holst & Nolan 1995; Zsiga 1995; Niebuhr et al. in press) have demonstrated that coarticulation between phrase-internal coronal obstruent sequences which differ in sub-coronal features (namely, anteriority) is unexpectedly regressive, and *not* contrast-neutralizing, and placing it outside the phonology. The rule stated in (2) does not need to

be modified to account for this data, and the historical account given above can explain this outcome of syncope if one simply assumes that word-final sequences of segments differing only on sub-coronal place features pose the same sort of recoverability problem that word-final geminates do.

4. /-z/ in English dialects

Data from English dialects with advanced rates of deletion of final /t, d/ in consonant clusters suggest that geminate avoidance may not always be active. Labov et al. (1968: 331) give the following close transcriptions of *ghosts* as produced by “Money”, a speaker of African-American Vernacular English (AAVE) living in Harlem, NYC:

- (11) a. gos:
 b. gos**iz**
 c. gosts**is**

The final devoiced geminate in (11a) violates both NOGEM and AGREE[VOICE], and the doubly-affixed (11c) incurs a gratuitous violation of faithfulness. Other data suggest that epenthesis may occur when there is no risk of geminate formation, such as after stem-final /st/; Wright (1905: 261) and Jespersen (1948: 189) report the following British dialectal forms:

- (12) a. ⟨bistes⟩ ‘beasts’
 b. ⟨postes⟩ ‘posts’
 c. ⟨gostes⟩ ‘ghosts’

This also occurs in higher registers of AAVE; the following was observed by the first author during an academic panel discussion:

- (13) a. kɒnsist-ə**z** ‘consists’
 b. dʌst-ə**z** ‘dusts’

Both (12) and (13) follow from the leakage account if /t/ was lost completely, and then later added in by contact with dialects which at least variably preserved it. Jespersen alludes to some orthoepic evidence that the /t/ in ⟨bistes⟩ is a reaction to the stigmatization of /t, d/-deletion in the London area in the 17th century, and /t, d/-deletion is basically complete in the AAVE basilect, but deletion is less advanced in Modern Standard English with which the high-register AAVE data is in contact with. However, while NOGEM

could be reformulated to ignore the /t/, such an account would scarcely preserve the original intuition that geminate avoidance triggers epenthesis.

5. Sufficiently-similar deletion in Catalan

Cameron et al. (2010) consider a process in Catalan which deletes a word-final obstruent when preceded by a homorganic sonorant, shown in (14).

| | <i>masc. sg.</i> | <i>fem. sg.</i> | | |
|------|------------------|-----------------|---------|--------------------|
| (14) | a. al | altə | ‘tall’ | |
| | b. kur | kurtə | ‘short’ | |
| | c. blaŋ | blaŋkə | ‘white’ | |
| | d. prufun | prufundə | ‘deep’ | |
| | e. askerp | askerpə | ‘shy’ | (masc. sg. *asker) |
| | f. lʲark | lʲarɣə | ‘long’ | (masc. sg. *lʲark) |

(14ef) do not meet the conditions for deletion. Since homorganicity is the condition for deletion, Cameron et al. analyze this pattern as avoidance of sufficiently similar segments which agree on major place features:

$$(15) \quad \text{DEGEMINATION: } C[+\text{OBS}]_1 \rightarrow \emptyset / C[+\text{SON}]_2 _ \# \\ \forall F_i \in \{\text{LAB, COR, DOR}\} : [(\alpha F_i)_1] = [(\beta F_i)_2]$$

Since the “pathology” is a sequence of sufficiently similar segments, this would appear to fall under the purview of CDF, despite the different “cure”. The CDF analysis must posit high-ranked AGREE constraints to account for the fact that manner is ignored for the determination of sufficient similarity. This predicts that all manner features will assimilate, though this is false for Catalan. For the input /askerp/ ‘shy (masc. sg.)’, the family of undominated AGREE[MANNER] constraints will rule out faithful [askerp], and NOGEM will rule out assimilating *[asker:]. The emerging unmarked winner will, incorrectly, be *[asker]. No such problem is encountered with rule (15).

6. Counterbleeding in New Julfa Armenian

Baković, following Kenstowicz & Kisseberth (1971), makes the claim that epenthesis counterbled by assimilation is unattested, but a counterexample comes from the future proclitic /k-/ in the New Julfa dialect of Armenian (Vaux 1998: 216; Vaux in press) shown in (16).

- (16)
- | | | |
|----|--|--|
| a. | kə tam | ‘I will come’ |
| b. | gə lam | ‘I will cry’ |
| c. | k^hət^huoɪ niem | ‘I will allow’ |
| d. | g^həd^hə niem | ‘I will put’ |
| e. | g^h avadam | ‘I will believe’ (cf. havadam ‘to believe’) |

Since laryngeal state assimilates even when epenthesis applies, Vaux proposes that assimilation applies after epenthesis. This non-interaction is inexpressible in “classic” OT, however, since the winning candidates in (16b-e) all incur gratuitous violations of faithfulness.

Baković (2007: 247) suggests that epenthetic vowels can be transparent to the AGREE family, and further suggests this would be falsified only by a counterbleeding pattern where epenthesis appears to apply over epenthetic vowels which are “distributionally distinguishable from otherwise identical underlying vowels . . . and in which assimilation applies only across the epenthetic vowels” (p. 247). “Distributionally distinguishable” is in the eyes of the beholder, however. This can be seen from the fact that Vaux (2003: 104f.) motivates his treatment of root-internal [ə] as epenthetic not for phonetic or phonological reasons (as one might expect), but rather to account for opacity in allomorph selection. Baković argues that “to the extent that the type of pattern considered in this subsection is indeed unattested, OT has a clear advantage over *SPE*, in which the analysis of this unattested pattern is as straightforward as any other.” This too is too strong, since Baković suggests (fn. 20) two ways this could be encoded in OT by “brute force”. In other words, this claim to grammatical restrictivity is nothing more than an poorly-defined notion of the relative elegance of analyzing counterbleeding-on-environment interactions in OT, and therefore has little probative value.⁵

7. Geminate avoidance and speech rate in Polish

Pająk & Baković (in press) argue for a formal connection between epenthesis and assimilation with variation data concerning the Polish proclitic /z-/ (in what follows, all data comes from Pająk & Baković in press, henceforth

⁵ This typological claim above faces a familiar problems for a typologically grounded phonology: it asserts that a gap is structural, and later evidence shows this to be an artifact of sampling. Yet, even if the data was not falsified, typological gaps are insufficient to rule out synchronic representations (cf. Hale & Reiss 2008: chap. 7).

P&B). Voicing assimilation targets this proclitic, as in (17b).

- (17) a. **zb**zikovátɕ ‘to become crazy’
 b. sk**f**asɛm ‘with acid’

There is also an “optional” rule of sub-coronal place assimilation.

- (18) *assimilation* \neg *assimilation*
zdzvʲigʲɛm **zd**zvʲigʲɛm ‘with a crain’

CDF thus predicts that voicing, and optionally sub-coronal place, will be ignored for the computation of sufficient similarity. However, epenthesis does not apply when a “simple” geminate is formed. Rather, the process of epenthesis (itself the descendent of an older rule of *jer*-deletion) applies “optionally” to clusters where a sequences of sufficiently-similar segments would be followed by another consonant, as in (19c).

- (19) *epenthesis* \neg *epenthesis*
 a. ***s**ɛsɛrɛm **s**:ɛrɛm ‘with cheese’
 b. ***z**ɛz**am**ku **z**:amku ‘from a castle’
 c. **z**ɛ**z**rɛbakʲɛm **z**zrɛbakʲɛm ‘with a colt’

As can be seen from the first and third columns of (20), epenthesis bleeds assimilation (*c.b.* indicates the results derived from assimilation and epenthesis in a counterbleeding relationship). The second column indicates, however, if epenthesis fails to apply, assimilation is ruled out in this environment.

- (20) *epenthesis* *assimilation* *c.b.*
 a. **z**ɛ**z**nakʲɛm ***z**:nakʲɛm (n.a.) ‘with a sign’
 b. **z**ɛskawõ ***s**:kawõ ***s**ɛkawõ ‘with a rock’
 c. **z**ɛ**z**rɔdwa ***z**:rɔdwa ***z**ɛ**z**rɔdwa ‘from a spring’

Despite the minor complication that the analysis requires a contextual version of the NOGEM constraint (since geminates are permitted except immediately before other consonants), the data presented appear to be consistent with the first prediction of CDF: as shown, voice and sub-coronal place are ignored for the computation of sufficient similarity, and both assimilate.

P&B make a much stronger claim, however. Recall that in Polish, epenthesis may apply where sub-coronal place assimilation would counter-factually create a cluster of a geminate followed by a consonant, and that both epenthesis

and sub-coronal place assimilation are both variable. The authors suggest that this variability suggests they share a single grammatical motivation (in this case, the high ranking of an AGREE constraint, which is taken to be “stochastically active” to generate this variation), despite the fact that, as the authors note, the rates at which sub-coronal place assimilation and epenthesis apply are very different. We cannot see why the simple presence of variability should provide evidence for a shared grammatical motivation. This is made clearest by a *reductio ad absurdum*: both /t, d/-deletion and “g-dropping” are variable in Modern English, but to our knowledge, no one has suggested that the two are linked, despite the fact they both target a similar phonological environment, (i.e., word-final consonants).

As noted by a reviewer of P&B’s study, in Polish, epenthesis occurs more often in slow speech, whereas sub-coronal place assimilation occurs less often. P&B note that this can easily be accommodated if the activation of the high-ranked AGREE constraint is sensitive to speech rate. However, that is not the full story: the activation of this constraint is determined by a strong interaction between speech rate and whether a candidate exhibits sub-coronal place assimilation or epenthesis. P&B suggest the proper way to generate this strong interaction is to allow speech rate to have a different effect when evaluating candidates with or without sub-coronal place assimilation than when evaluating candidates with or without epenthesis. Of course, as shown above, these environments overlap, so candidates with sub-coronal place assimilation need to be kept out of the epenthesis tableaux, and vis versa. This would appear to be tantamount to denying Richness of the Base; though other analysts have made this move, it is hardly privileged.

Even if we admit this powerful mechanism into the grammar, MacKenzie (2009a) finds, in a survey of the variationist literature, that there are no attested cases of strong interactions between grammar-internal predictors of linguistic variation (in this case, the different contexts in which epenthesis and place assimilation occur) and grammar-external (but speaker-internal) predictors (such as speech rate), a result that was anticipated much earlier (e.g., Sankoff & Labov 1979: 212f.). Indeed, MacKenzie makes the intuitive argument that this state of affairs is exactly what is predicted if, contra P&B, speaker-internal differences in “style”, speech rate, etc., map onto slightly different grammars. In conclusion, Polish provides strong evidence to separate the triggers of sub-coronal place assimilation and epenthesis.

8. Conclusion

The above case studies show that CDF is too restrictive to account for known grammars, and is best understood as a tendency resulting from historical interaction between processes that produce homophony. This account provides a morphophonological mechanism by which homophony avoidance might be understood, though it does not necessarily rule out a phonetic account, such as one advanced by Odden (1988: 470). Odden suggests that the gesture of non-identical consonants may show more partial overlap than repeated identical gestures, which may not. Therefore, this might lead to phonetically shorter vowels between non-similar consonants, which are in turn more likely to be deleted than the longer vowels between similar consonants. Alternatively, this length pattern may be phonologized before deletion.

We further propose that the leakage account may be the proper analysis for other studies which show apparent exceptions to the regularity of sound change (e.g., Labov 1994: part E; Guy 1996; MacKenzie 2009b; Mondon 2009a,b), all of which rely on the notion that deletion or reduction may produce homophony which is not easily recovered. Further work should investigate the role of morpheme and word in conditioning these underapplications, whether diachronic or synchronic.

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