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VARIATION IN AMERICAN ENGLISH FLAPPING

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ABSTRACT

Phonological treatments of flapping have classed it as a categorical postlexical rule of American English. Using data from two large corpora, I show that flapping occurs in environments previously considered immune to the process, and I present evidence that flapping is variable, subject to dialectal, stylistic and linguistic conditioning.

1. INTRODUCTION

Flapping of /v/ in words like *city* and *butler* is one of the most distinctive characteristics of North American English, setting it apart from British English and many other varieties. Flapping is an instance of lenition or weakening in which the intervocalic voiceless alveolar stop assimilates to the [+voice] feature of the surrounding vocalic environment.¹ Flapping has received a great deal of attention in the phonological literature, and a handful of sociolinguistic studies have examined flapping in various English dialects. However, no comparable work has been done on American English flapping.

2. PHONOLOGICAL ACCOUNTS OF FLAPPING

Traditional phonological analyses of flapping have primarily been concerned with two aspects of the process: the nature of the segment itself, and the nature of the flapping environment, particularly with respect to syllable structure. Kahn (1980), in his substantial treatment of flapping, states that flapping occurs after any non-consonantal segment. Treating /v/ as a glide, he allows for flapped /v/ in *party*. Although /v/ is a [-cons] segment, it optionally deletes, leaving /v/ in a flapping environment for words like *winter*. To account for the possibility of flap following /v/ (as in *guilty*), Kahn stipulates that speakers who flap here have a non-consonantal /v/ as opposed to the standard [+cons] /v/.

Selkirk (1982) limits flapping to intervocalic environments, while Inouye (1989) follows Kahn and permits flapping following any [-cons]

1. Zue and Lafertiere (1979), in their acoustic study of American English flapping, contend that /d/ as well as /v/ can undergo flapping. While voicing is one element which characterizes /v/ flapping, flapped /v/ and /d/ are also short in duration (~30 ms) with little or no burst accompanying release, thus distinguishing them from their plain stop counterparts. I limit my discussion of flapping in this paper to /v/.

segment (Fiegerich (1992) broadens the flapping environment to include any preceding sonorant (accounting for *party*, *winter* and *melied*), while Jensen's (1993) rule is limited to intervocalic flapping. Jensen does allow for post-nasal flapping through a nasal deletion rule (following Kahn). All of these phonological accounts completely disallow flapping in words with a following syllabic nasal or schwa plus nasal segment, as in *button*. Despite the differences in treatment of these secondary flapping environments, there is complete agreement on the **core flapping environment**, whereby intervocalic /t/ flaps in a falling stress pattern:

(1) Core Flapping Environment?

t, (d) --> r / V __ V
[-str]

e.g. *city*, *butter*

The **peripheral flapping environments** and a synopsis of their treatment within the phonological literature appear in (2).

(2) Peripheral flapping environments

ENVIRONMENT	EXAMPLE	FLAPPED?
nV	e.g. <i>party</i>	usually
nV	e.g. <i>winter</i>	sometimes
hV	e.g. <i>guilty</i>	rarely
(r,n,l)hN	e.g. <i>button</i> , <i>sentence</i>	impossible
	<i>important</i> , <i>mollen</i>	

Implicit in the phonological accounts of flapping in peripheral environments is the notion of variability. Only flapping of intervocalic /t/, explanation of this implied variation is provided. Flapping is often described as a fast or casual speech process, thus introducing style as a factor. Furthermore, flapping in peripheral environments is sometimes described as sporadic, and is often accompanied by optional rules like nasal deletion.

To summarize, the phonological accounts of flapping in American English are inadequate for a number of reasons. Most importantly, the current literature is based substantially on introspective judgments and anecdotal evidence. A number of problems emerge from such an approach. First is the lack of consensus about the extension of flapping beyond the

2. Flapping is a postlexical rule and as such occurs across word boundaries, as in *get a job*. I consider only word-internal flapping in this paper.

core environment. Additionally, the dimension of style has often been vaguely alluded to as a factor in American English flapping but has never been precisely characterized or properly studied. Finally, while variation in flapping is acknowledged, it is never given a comprehensive treatment.

3. PREVIOUS STUDIES OF FLAPPING VARIATION

In addition to formal phonological treatments of flapping, there have been noteworthy sociolinguistic studies of two national varieties of English. The first variety to receive a fair amount of attention has been Canadian English (CE). DeWolf's (1990, 1992) large scale study of CE in Ottawa and Vancouver examines flapping in two environments: intervocalically (VV, as in *butter*) and following a nasal (nV, as in *winter*). She reports that CE flapping is significantly conditioned by age, gender, socioeconomic class and style. Young speakers, men, lower social classes and informal settings all favor higher rates of flapping. Woods' (1991) study reports substantially similar results for Ottawa English.

Bell (1977) provides the first evidence that flapping is subject to stylistic considerations in New Zealand English (NZE), reporting that radio announcers use variable rates of flapping depending on their target audience. Holmes' (1994) comprehensive study of NZE flapping shows that while overall flapping rates are lower, the variable in NZE patterns much like CE. Holmes also finds that young speakers, men, and working class speakers show a significantly higher use of flap, and that young women also play an important role with higher than expected rates. Conversational style also favors flapping in the NZE data.

The sociolinguistic profiles of flapping in these two varieties is remarkably similar. As Holmes points out, in both cases the data appears to suggest a change from below. In addition to these two large studies of flapping variation, variable flapping has been mentioned for Cockney, RP, Australian, Welsh and Ulster English.

For American English, however, there is a real lack of information about the sociolinguistics of flapping. One minor study focusing on the acoustics of flap did find puzzling gender differences in the phonetic realization of flap. Zue and Lateralre (1979) find that the duration of flap was significantly longer for men than women; they also note, without explanation, some "idiosyncratic differences" among speakers for flapping rates in various phonological environments. Never, though, has there been a large scale empirical study of the social correlates of American English flapping. The present study addresses this lack of information.

4. THE PRESENT STUDY

This study uses two large speech corpora, available from the Linguistic Data Consortium (University of Pennsylvania). **Switchboard** is a corpus of phone conversations between 500+ people in which callers discuss pre-assigned topics with strangers. The callers are coded for regional background, age, education and gender. **HUB-4** is a collection of over one hundred hours of broadcast news recordings. While no personal information such as geographic background or age is available for the HUB-4 speakers, this information is less relevant due to the somewhat artificial standards of broadcast speech.

These corpora represent two middle-range varieties with respect to style. **Switchboard** does not represent truly casual speech because the speakers are strangers speaking about an artificial, pre-assigned topic. Nor is HUB-4 as formal a style as one might assume, given that the recordings come from news broadcasts. In fact, the style adopted by many of the reporters is quite casual and chatty. Moreover, much of the speech is from interviews and spontaneous speech between reporters, rather than reading of prepared texts.

A brief examination of 50 tokens of *city* and *pretty*, which meet the core flapping environment, reveals virtually no variation – flapping was categorical, so these environments were not considered further.³ Two additions were made to the original list of peripheral environments. First, I examined the status of intervocalic /t/ between two unstressed syllables (e.g. responsibility, relative). Second, I examined a handful of post-tonic tokens where the following vowel receives secondary stress (NATO, veto, motto). For each of the test words, I recorded every occurrence in **Switchboard** and HUB-4 as either flapped or unflapped. No finer distinctions were made.⁴ A complete list of test environments and words examined appears in (3).

3. Occasionally in the HUB-4 corpus, a newscaster would pronounce the word *city* as [sɪtɪ], with no flap. This seems to be a case of hypercorrection, but it is possible that in highly formal styles even the core flapping environment is variable. A closer examination of tokens in a wide range of styles will be necessary to address this question further.

4. Zue and Lafreniere (1979) report that flapping is a gradient process, with several possible acoustic correlates, rather than a binary one. The auditory cues for /t/ flapping, however, are largely based on the presence or absence of voicing. Here, as in other sociolinguistic treatments of flapping (e.g. DeWolf (1990) and Holmes (1994)), I treat flapping as a binary variable.

(3) Test environments and words

ENVIRONMENT	test words
rV	forty, party, starting center, plenty, painting, rented, Atlantic, Atlanta
nV ⁵	guilty, filter, shelter, delta, melted, faulty
IV	button, mitten, kitten, Satan important
tN	sentence, mountain, Clinton
nN	molten
IN	responsibility, community, opportunity, possibility
non post-tonic VtV	relative, relatively veto, motto, NATO
Vto	

The overall rates of flapping and number of tokens in each environment appear in (4).

ENVIRONMENT	(4) Overall rates of flapping in two corpora	
	SWITCHBOARD (N=1145)	HUB-4 (N=478)
	rate	rate
rV	~100% (n=60)	~95% (n=39)
nV	88.8% (276)	57.3% (122)
IV	10% (159)	0% (36)
tN	0% (20)	0% (4)
nN	5% (274)	0% (93)
IN	21.7% (83)	4% (25)
IN	0% (5)	0% (3)
VtV	64.5% (256)	72.8% (114)
Vto	75% (12)	42.9% (42)

For those environments which showed variation and which contained an adequate number of tokens, I proceeded to investigate their correlation

5. For nV words, there is some question as to what is meant by "flapping." Phonological treatments rely on a nasal deletion rule, which leaves /t/ in an intervocalic position, to explain flapping. Zue and Lafreniere (1979) actually report four possible realizations of nV clusters: 1) retention of all segments; 2) deletion of /n/ and retention of /t/; 3) deletion of /t/ and retention of /n/; and 4) deletion of /n/ and flapping of /t/. For the purposes of this study, I labeled any of the realizations 2-4 as flapped.

with social factors. First, I examined the regional patterning of flap environments in Switchboard (the only corpus coded for geographic background) and found three major patterns. These results are displayed in (5).

(5) **Regional variation in flapping in Switchboard**

(4)	<i>important</i>	<i>sentence</i>
SOUTH & SMID	12% (100)	48.6% (35)
OTHER	1.1% (174)	2.7% (37)

(b) ***-ity* words**

AAVE	0% (32)
SOUTH & SMID	72.9% (59)
OTHER	100% (118)

(c) ***guilty, filter, shelter, melted***

NMID	47% (17)
WEST	27.7% (18)
OTHER	3.2% (124)

NOTE: All results significant at $p < .001$

For the environment (r.n.)N where /r/ is preceded by a sonorant and followed by a reduced vowel plus nasal (or frequently, a syllabic nasal), there were only two words which occurred frequently enough to warrant a careful look. In both *important* and *sentence*, the prevalent American pronunciation is with a syllabic nasal. Rather than being flapped, the /r/ in this environment is typically glottalized. For this reason, phonologists have argued that this is an impossible environment for flapping.

However, in the South and South Midland dialect regions, a different pattern is obtained. Flapping in this environment is indeed possible, and the following syllable is realized as a schwa plus nasal rather than a syllabic nasal. As shown in (5a), the flapped pronunciation of *important*, [ɪmˈpɔːrt(ə)nt], occurs 12% of the time in the South and South Midland while only a handful of times in the other regions. Similarly, a flap occurs in *sentence*⁶ nearly 50% of the time in the South and South Midland, while the word was flapped only once in the other regions. These Southern flapping rates are remarkably high for an environment which phonology has treated as categorically unflapped.

6. Both [senəns] and [sɛrəns] were coded as flapped tokens; see footnote 3.

For the other test words in this environment, *Clinton* and *mountain*, Southerners and South Midlanders are no more likely to flap than any other speakers. Indeed, these words are quite rare in the Switchboard corpus, and their flapped variants do not occur at all. Why there should be a difference between the phonologically similar words *sentence*, *mountain* and *Clinton* is not at all clear. It should be noted that for both *sentence* and *important*, a consonant follows the (syllabic) nasal, whereas this is not the case for *Clinton* or *mountain*. In addition, *Clinton* and *mountain* occur at a much lower frequency in the corpora than do *sentence* and *important*. Perhaps one or both of these facts will eventually provide an explanation; for the time being, the high rates of flapping in these words remains a mystery.

A lack of data unfortunately prevented a closer examination of the patterns of the other test words with following syllabic nasals, *kitten*, *button* and *mother*. Anecdotally, I have noted the occurrence of flap in these and similar words, as in [kɪtən] and [bʌtən], among speakers in the North and New England, although never in the South or South Midland. Most words in this environment are very low frequency, making it difficult to discern their pattern for spontaneous speech.

A second regional pattern that emerges is in a subset of the words in which /r/ falls between two unstressed vowels. For the *-ity* words, *responsibility*, *community*, *opportunity* and *possibility*, the pattern shown above in (5b) was found. Southerners and South Midlanders are significantly less likely to flap than are the other speakers, for whom flapping in this environment proved categorical. But even more striking was the behavior of speakers of African American Vernacular English (AAVE). The Switchboard corpus is not coded for race or ethnicity. However, in examining the HUB-4 corpus, I came across a two-hour program which features the spontaneous speech of dozens of self-identified black Americans discussing the impact of casinos on their towns. While not directly comparable to the Switchboard or HUB-4 corpora, this additional data does at least provide an interesting comparison. In the speech examined, the AAVE speakers never flap in words like *opportunity*. The categorical non-flapping by AAVE speakers for this environment stands in stark contrast to the categorical flapping for non-Southerners, while Southerners seem to occupy a middle ground.

The final regional pattern found in the data occurs in the environment /r/ reported in (5c). Kenyon (1951) notes the possibility of flapping in this environment, but more recent phonological treatments have considered it anomalous if not impossible. But in the North Midland, speakers flap nearly half of all tokens of words like *guilty*, *filter*, *melted* and *shelter*, while Westerners flap in this environment 28% of the time, a significant difference from the rest of the nation which shows only sporadic flapping

tokens. Kahn (1980) states that speakers who flap in this environment must have non consonantal /l/, thereby allowing his flapping rule to account for these cases. Although Kahn does not provide evidence for this stipulation, he may be on the right track. Speakers in the North Midland and West have a tendency to vocalize non pre-vocalic /l/, resulting in a non consonantal /l/ in words like *guilty*, *shelter*. However, other regions of the country also show /l/-vocalization (including some Southern and Mid-Atlantic dialects), but these speakers did not show flapping in this environment. A more extensive study of /lV flapping which considers the possible interaction of this process with /l/-vocalization is required.

With these three significant findings, peripheral flapping environments should no longer be viewed as random or sporadic, as is suggested by the lack of consensus in the phonological literature. Rather, these environments are subject to strong dialect conditioning and display patterned variation. It is hoped that consideration of greater numbers of tokens, particularly in the /lV (*guilty*) and /lN (*butler*) environments, will reveal further dialect variation in American English flapping.

In addition to the regional data, I also examined differences in flapping with respect to gender and education. Surprisingly, there were absolutely no significant differences in flapping rates along these dimensions. Men's and women's rates of flapping were virtually identical for most words, and no significant effects of education were found.

This lack of variation is unexpected in light of the previous studies of Canadian and New Zealand English. One possible explanation lies in the nature of the Switchboard corpus. The range of educational backgrounds in the corpus is quite limited, consisting primarily of college-educated white collar professionals. Any potential gender differences may have been dampened down by the lack of social diversity, and the restricted range of educational attainment contributes to a lack of variation there. Additionally, flapping has reached a more advanced stage in American English compared with CE and NZE, and earlier social differences may have faded away over time. However, this remains a puzzling result.

The final dimension of flapping variation considered in this study is style. The speech of network news anchors studied in the HUB-4 corpus is a more formal variety than the spontaneous conversations of the Switchboard callers. This is not to suggest that the broadcast speech of HUB-4 is *careful* while the Switchboard corpus is *casual*. HUB-4 does in fact contain a fair amount of spontaneous speech. But the style of news broadcasts is undeniably more formal than phone conversations.

Stylistic considerations do play an important role in this data, as was the case in New Zealand and Canada. There were seven environments in which both Switchboard and HUB-4 provided ample variable data for

comparison, and in five of these cases the differences were significant, with the spontaneous speech in Switchboard yielding consistently higher rates of flapping. The overall results for stylistic variation are reported in (6).

(6) Overall rates of flapping in six environments

	nIV*		Vto**		-iV#		-fiV#	
SWITCHBD	93.8%	(n=178)	75%	(12)	90.9%	(177)	5.1%	(79)
HUB-4	56.4%	(110)	42.9%	(42)	93.3%	(89)	0%	(25)
	rIN**		rIN**		rIV**			
SWITCHBD	5%		24.7%		(73)			
10.1%	(159)							
HUB-4	0%		4%		(25)		0%	
	(93)						(36)	

NOTE: *significant at p<.001 **significant at p<.05 #not significant

The largest of these differences occurred in the environment nV, as in *Atlanta* and *center*. The Switchboard callers flapped in this environment nearly 94% of the time, while the newscasters flapped only a little over half the time.

Next is the case of the words *vero*, *NATO* and *motto*, which actually meet the description of the core flapping rule but are unusual in that /V/ is followed by a stressed vowel rather than a reduced and/or unstressed vowel. Again, Switchboard callers are significantly more likely to flap these words than the broadcasters. The difference between the variability of this environment versus the near-categorical flapping of words like *butler* suggests that prosody plays a role in American English flapping.

For the -iy and -ive words, where intervocalic /V/ appears between two unstressed vowels, the Switchboard and HUB-4 data proved to show only insignificant differences. For words with the -iy suffix (*responsibility*, *community*, *opportunity*, *possibility*), both corpora showed very high rates of flapping, whereas the -ive words (*relative*, *relatively*) strongly resisted flapping, showing only a handful of flapped tokens in Switchboard and none in HUB-4. Despite their phonological similarity, the two word types in this group exhibit very different behavior. Both are nearly categorical, which may explain the lack of stylistic variation, but their near-categorical patterns go in opposite directions. No immediate explanation of this difference is apparent.

I turn again now to the cases of rN (*sentence*), rN (*important*), and /V (*guilty*), all of which showed strong regional conditioning. In all three cases, the overall rates for flapping are significantly higher in the Switchboard corpus, even with the inclusion of tokens from those regions

which disfavored flapping in these environments. Interestingly, it is precisely these three highly variable environments which are most often considered unlikely or impossible to flap in phonological treatments of flapping.

5. CONCLUSION

With the present study, flapping in American English has emerged as a variable process, subject to linguistic and social conditioning. This study has begun to remedy the previous lack of data on the subject, but there are many unanswered questions. The data presented here are from a much larger study of variation in flapping, the first results from my dissertation on the topic. A number of the outstanding questions about flapping will be addressed in my dissertation.

First is the lack of diversity in Switchboard with respect to the callers. Another LDC corpus, CallFriend, will be added to the present corpora. CallFriend consists of spontaneous speech between friends and family members gathered from over 100 hours of recorded telephone calls. The addition of CallFriend is essential in two ways. First, the range of social variation is much wider than that of Switchboard. This will permit a proper analysis of the effect of gender and education on flapping. Secondly, the new corpus will add another stylistic dimension to the data. I will also consider further data from newscasts which use a more formal speech style and more prepared text than the data presented here.

The present paper examines only the social factors involved in flapping. However, linguistic factors also play a crucial role. For instance, I noted a difference between flapping rates for *sentence* versus *Clinton* and *mountain*. What linguistic factors can help explain this apparent case of lexical diffusion?

Additionally, flapping is a post-lexical rule and therefore occurs across word boundaries. Is this also a variable process? Is there any significant effect of syntactic boundaries on cross-word flapping? And similarly, is there a consistent effect of morphological structure on word-internal flapping?

Finally, flapping can be related to other lenition processes, most notably -r, -d deletion. Does the voicing associated with flapped segments interact with -t, -d deletion rates? And in what ways is flapping variation akin to the stable variation found in -t, -d deletion?

Despite these lingering questions, the present study has contributed to our understanding of flapping, which emerges as a complex variable rather than a categorical rule of American English.

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