Production Planning Effects on Variable Contraction in English

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1 Introduction

The factors that condition linguistic variation are traditionally recognized to fall into two types: "external" factors represent non-linguistic characteristics of the speaker or situational context; "internal" factors comprise linguistic elements surrounding the variable item (Cedergren and Sankoff 1974). However, often unacknowledged (though see Preston 2004 and Tamminga et al., to appear) is that *psycholinguistic* factors, such as those implicated in language processing and production, must also play a role in shaping the surface distribution of linguistic variants. Indeed, though both variationist sociolinguistics and the psycholinguistics of language production address questions of why and how the language we produce takes the shape that it does, there has to date been little overlap between the two fields.

The present paper is situated in a line of inquiry that seeks to change this. In this paper, I probe this third category of conditioning factors by exploring the potential role of the incremental planning of speech in interfering with the conditioning of the variable contraction of English *is*. Previous research has found that a variable alternation which is conditioned by the nature of the element that follows it can have this conditioning disrupted when a speaker fails to plan what that following element will be (Wagner 2011, Tanner et al. 2015). The strength of the effect of that following element on the variable alternation thus diminishes, the less likely advance planning is. I extend this research, which has so far only examined following *phonological* elements, to look at whether this finding holds when a following element effect is localized in the *syntactic* domain.

Taking *is*-contraction as my dependent variable, I first provide a detailed account of the role of following constituent category in conditioning this variable, documenting a robust effect in Mainstream American English with a hierarchy of environments very similar to what has been found in studies of the contraction and deletion of *is* in African American English (Section 4.1). I then investigate an acoustic proxy for advance planning—duration of the word following *is*—and find that, while it does play a role in conditioning contraction, it does not interact with the following constituent effect (Section 4.2). In Section 5, I discuss a possible explanation for this, connected to the proposal that advance planning scope differs for different levels of grammar (Wagner et al. 2010). More broadly, I underscore that the patterning of sociolinguistic variation may be shaped, not only by the language-internal and social factors that are familiar from decades of research, but also by constraints on the language production system.

2 Background

2.1 Incremental Planning and Variation

Many recent models of speech production assume that language production is *incremental*, with planning and production occurring in parallel. That is, speakers do not mentally form utterances in their entirety before speaking them, but rather plan out the later components of an utterance as they are producing the earlier ones (Ferreira and Swets 2002). This advance planning is not always perfectly executed, though: a speaker's ability to plan ahead may be compromised by, for instance, a cognitive load or a distraction, or if the material being produced is particularly structurally complex (Ferreira 1991, Wagner et al. 2010). In such cases, even though the speaker is eventually able to figure out what they want to say next and carry on, there is a possibility that the linguistic information that eventually materializes in a later component of the utterance was not available at the time of production of the earlier one.

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This, in turn, has implications for linguistic variation of the type that sociolinguists are interested in, because many such linguistic variables are known to be conditioned by surrounding elements of language. For instance, the classic sociolinguistic variable of coronal stop deletion—the variable deletion of /t/ and /d/ in word-final consonant clusters—is well known to apply at a higher rate before consonants than before vowels (Labov et al. 1968, Guy 1980, *inter alia*). But if a speaker has failed to plan the following segment at the moment they go to produce the variable context—so, in this case, at the moment they go to choose between articulating the /t/ or /d/, or not—no following material will be present to condition the choice. A documented effect of following segment on a variable's patterning, then, should be mitigated, if not erased entirely, in cases where a speaker's planning of said following segment was disrupted. Tanner et al. (2015) call this the *production planning hypothesis* (PPH).

The PPH has been tested in two recent studies, each of which investigates whether a known effect of a following segment is indeed mitigated in cases where advance planning is likely to have been compromised. Wagner (2011, 2012) tests the PPH on assimilation of the *-ing* suffix to a following coronal consonant, giving [ɪn].[1] Tanner et al. (2015) test the PPH on the well-known following segment effect on coronal stop deletion described above.

To answer the question of whether these following segment effects are mitigated when advance planning is compromised, a researcher needs to know whether or not planning of that segment has occurred. This is non-trivial, and researchers have operationalized advance planning in various ways. Wagner (2012) uses two proxies for advance planning. The first is the presence of a syntactic boundary between the varying item (the *-ing* suffix) and the following segment, under the assumption that advance planning is less likely when the two words are separated by a clause boundary. Wagner does find significantly less assimilation when a clause boundary separates the nasal from a following coronal consonant, but the aforementioned assumption is a big one: Wagner's subjects were reading written sentences, where the planning process is likely to be different from that of online speech production, so this effect is more likely attributable to, say, the close environment necessitated for assimilation being destroyed. More convincing are the results from a second, acoustic proxy for planning: the duration of the word following *-ing* (controlled to be *the* in all cases). As Wagner explains it, a word of longer duration is likely to mark the presence of a prosodic boundary, due to a process of "initial strengthening" (Keating 2006; see also Shattuck-Hufnagel 2014:262). And, as there is evidence that prosodic domains and planning domains coincide (Shattuck-Hufnagel 2000), longer duration can be taken as a proxy for planning boundary placement. So, we should expect to find a decreased rate of *-ing* assimilation with longer following words, and indeed this is what Wagner finds, even when no clause boundary separates *-ing* from the following segment.

Tanner et al. (2015) operationalize planning by measuring the duration of pause between the site of variation and the following segment. They find that, the longer the pause separating underlying *t/d* from what follows, the less likely the following segment is to influence *t/d*-deletion (and, indeed, the less likely *t/d*-deletion is to occur at all). That is, they find a significant interaction between following pause duration and following segment, with more deletion before consonants than vowels when the deletion site and the following segment are close, but no difference between these segment types when a pause separates deletion site and following segment. Again, assuming that pause can be taken as a proxy for planning, with longer pauses meaning that following material is less likely to be planned and hence less likely to be available to condition deletion, this confirms the PPH.

Both Wagner 2012 and Tanner et al. 2015 test the PPH on linguistic variables which are influenced by a following segment. The effect tested for planning-induced mitigation is thus phonological in nature. The present paper investigates a variable for which the following conditioning effect is in the *syntactic* domain, to see whether the PPH still holds. This variable is contraction of the verb *is*, henceforth *is*-contraction.

[1] Wagner describes this as the same [ɪŋ]∼[ɪn] alternation that sociolinguists capture with the variable (ING), but I do not think that should be taken as given; see Tamminga 2014 and Tamminga et al. to appear for discussion of the possibility that surface [ɪŋ]∼[ɪn] alternations may have multiple underlying sources.

2.2 *Is*-Contraction

The phenomenon under study in this paper is the variation in phonological form of the English verb *is*. In a process typically called *(auxiliary) contraction* (though also referred to in some literature as *auxiliary reduction*), this verb may variably surface without its initial vowel and cliticized to its host (Labov 1969, Zwicky 1970, Kaisse 1983, MacKenzie 2013). This process is exemplified in (1); this and all subsequent examples come from the Switchboard Corpus (Godfrey et al. 1992), described further in Section 3.1.

(1) Yeah, Salzburg[z] nice. Austria[z] nice. Europe [ɪz] nice! (sw_1151)[2]

This variation has been found to be sensitive to a number of linguistic factors, including the nature of the subject of *is* (with more contraction after pronouns than full noun phrases), the length of a noun phrase subject (with more contraction after shorter than longer NPs), the preceding segment (with more contraction after vowels than consonants) and in some research, the nature of the constituent following the *is* (with more contraction before verbal than nominal complements) (Labov 1969, McElhinny 1993, MacKenzie 2012).

It is the latter of these four conditioning factors that is relevant here. Because the complement of *is* is a "following environment" like those examined by Wagner (2012) and Tanner et al. (2015) (albeit one in the syntactic, rather than the phonological, domain) we can examine whether its effect is similarly mitigated in cases where advance planning is likely to have been compromised.

The precise details of the effect of following constituent on *is*-contraction in Mainstream American English (MAE) are not completely clear from previous research. The bulk of the literature on the role of following constituent in shaping *is* variation focuses on its effect on contraction and deletion of *is* in African American English (AAE). As summarized in McElhinny (1993), researchers studying contraction and deletion of *is* in AAE generally find the hierarchy of complement types given in (2), where complement types are ordered from eliciting least to most contraction/deletion.

(2) noun phrase $<$ locative, adjective $<$ progressive verb $<$ *gonna/going to*

Where MAE contraction is concerned, the picture is fuzzier. McElhinny (1993) more or less finds the hierarchy in (2) to be replicated in her study of 20 white speakers of American English (N = 612), although she finds *gonna/going to* to fall at the opposite end of the hierarchy, below noun phrases and above only "miscellaneous." She also observes that individual speakers tend to show variation in this hierarchy (though token counts from any given individual are small). McElhinny's findings go in the same direction as, but show more granularity than, those of Labov (1969), who examined contraction of *is* among 8 white speakers from the Inwood neighborhood of Manhattan (N = 306). Labov finds contraction in MAE to effectively show a copula/auxiliary split: his Figure 7 (1969:733) shows speakers contracting at the same rate before noun phrases, adjectives and locatives, where *is* is syntactically a copula, and then at a single, higher rate for both progressive verbs and *gonna*, where *is* is syntactically an auxiliary. Finally, Rickford et al. (1991) cite results from an unpublished study of MAE contraction by Ralph Fasold, who fails to find following constituent to even reach significance in his data.

The present study is based on nearly twice as many tokens as McElhinny's, and nearly four times as many as Labov's. Thus, we are well-placed to develop a clearer picture of the nature of the following constituent effect on *is*-contraction in MAE. These results are presented in Section 4.1.

3 Methodology

3.1 Tokens and Dependent Variable

The data for the present study come from the Switchboard Corpus (Godfrey et al. 1992). Switchboard is a corpus of telephone conversations between native speakers of American English, paired

[2]Numbers in parentheses are speaker identification numbers from Switchboard.

at random by a robotic operator and assigned a topic to elicit a five to ten minute conversation. Tokens for this study were identified by searching transcripts for <is> or <'s> (and were then culled through to remove cases in which <'s> marked the genitive suffix or contracted *has*). Valid tokens of *is* were subsequently restricted to only those with a full noun phrase (i.e., non-pronoun) subject, given that *is*-contraction after pronoun subjects is effectively at ceiling in this corpus (MacKenzie 2013). Only tokens of *is*, not *are*, were selected for study; *are* does not show variation of the type exemplified in (1)—that is, between a syllabic and a non-syllabic form—after non-pronoun subjects, where only the syllabic form may surface (MacKenzie 2012).

Following MacKenzie 2012, 2013, tokens were also excluded from study if they preceded a movement or deletion site, appeared in a comparative subdeletion construction or a pseudo-cleft, bore contrastive stress, were fronted to begin a *yes-no* question, were separated from their subject by an adverb or an audible pause, followed a sibilant, took a clausal complement, or were negated. These are all environments which change the envelope of variation of this variable, either by introducing an additional variant (which is what happens when the copula is negated; it can surface as *is not*, *'s not*, or *isn't*), or by blocking a variant (which is what happens in the other listed contexts, where the non-syllabic form may not surface).

Because the nature of the constituent following *is* was important to this study, tokens in which *is* had no expressed complement (due to the speaker changing direction, as in 3, or stopping and restarting, as in 4) were also excluded.

(3) And the budget is just—I don't—we've got a new governor... (sw_1239)
(4) I also believe that, uh, the earth is—is a kind of a self-regulating system and uh it will clean itself up eventually.[3] (sw_1142)

After all these exclusions, 1032 tokens remained to be coded, uttered by 354 unique speakers (mean number of tokens uttered per speaker: 2.9). Each token was coded auditorily by the author for the dependent variable, the phonetic realization of *is*. Variants with an audible vowel were coded as *full*, and variants with no audible vowel were coded as *contracted*.

3.2 Independent Variables

3.2.1 Planning Proxy

Duration of following pause, the planning proxy used by Tanner et al. (2015), proved unworkable with the current data. In the vast majority of cases, going off of Switchboard's word-level alignment, there was no pause between *is* and the following word to be measured. A typical example is shown in Figure 1.

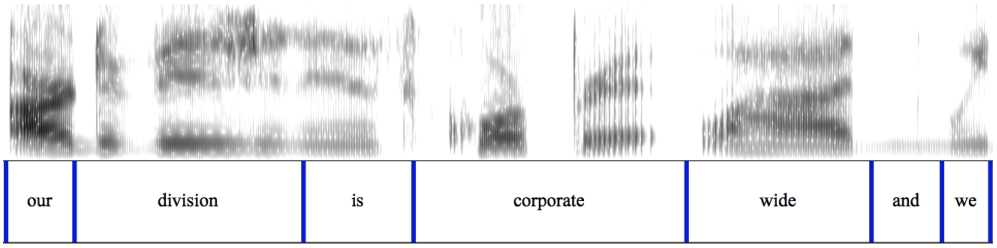

Figure 1: A typical example of transcribed, time-aligned speech from Switchboard, with no pauses demarcated between word boundaries.

Subtracting the timestamp marking the end of the *is* from the timestamp marking the beginning of the following word thus gave a median value of zero across the 1032 tokens coded.

[3] It's probably the case that the intended complement of the first *is* in this example was the same as the second *is*, but we can't know for sure, so tokens like this were excluded just to be safe.

The fact that Tanner et al. were able to robustly measure non-zero following pauses in their data is perhaps attributable to the fact that their variable, *t/d*-deletion, can occur phrase- and utterance-finally; contraction is illicit phrase-finally (see MacKenzie 2012), so all coded tokens of *is* appeared in running speech.

With following pause unavailable as a proxy, duration of the word following *is* was used instead, after Wagner 2012. This measure was obtained simply by subtracting that word's beginning timestamp from its ending timestamp.

3.2.2 Following Constituent Category

Following previous research (Labov 1969, Baugh 1980, Rickford et al. 1991, McElhinny 1993, *inter alia*), five different following constituent categories were coded:

(5) NOUN PHRASE: My name is Donna. (sw_1367)
(6) ADJECTIVE PHRASE: Budgeting is very important to us. (sw_1219)
(7) PREPOSITIONAL PHRASE: Our son is into heavy metal. (sw_1147)[4]
(8) PROGRESSIVE VERB: Gene's working on his cars. (sw_1481)
(9) *going to/gonna:* I don't think any politician's gonna do that. (sw_1102)

The data also contained a single token in which *is* formed part of the quotative *be like* (10).

(10) My daughter's like, "Mommy, can I help you with the laundry?" (sw_1005)

Quotative *like* is not a complement that has been addressed in previous work on *is* realization, and with only a single token of this type, cannot be treated as its own category in this study. Instead, following Haddican and Zweig's (2012) analysis of the syntax of *be like* constructions, this token was coded as having a prepositional phrase complement.

The data also contained 65 tokens in which a past participle followed *is*, as in (11).

(11) The girl's adopted. (sw_1128)

Past participle complements have not been given their own category in previous research on *is*-contraction or -deletion, or even been the subject of any methodological discussion in that literature. Presumably, they have been lumped in with adjectival complements, which is what was done here.

Wh-word complements, as in (12), were coded as noun phrases. These were rare.

(12) The job is what provides all of your needs. (sw_1413)

Finally, constituents introduced with an adverb (13) or discourse marker *like* (14) were coded for what followed the adverb or *like*.

(13) His arm is still developing until he's twenty-five. (sw_1127) (PROGRESSIVE VERB)
(14) Her mother's like ninety-seven or something. (sw_1336) (ADJECTIVE PHRASE)

The breakdown of the 1032 coded tokens by following constituent category is given in Table 1.

[4]Technically, previous researchers have used a LOCATIVE category instead of my PREPOSITIONAL PHRASE. However, I found LOCATIVE difficult to implement when coding. Though some constituents are clearly locatives in that they express the location of the subject (e.g., *The cat is on the roof*), it's not clear what previous researchers did with constituents that resemble locatives syntactically but have a figurative meaning (e.g., *The cat is on TV*). McElhinny (1993:373) appears to have coded these as MISCELLANEOUS, a category which she notes having used for "prepositional phrase[s] or adverb[s]." To keep consistency with the other categories coded for, I code these constituents based on their form, i.e., as prepositional phrases, rather than their function.

NOUN PHRASE	ADJECTIVE PHRASE	PREP. PHRASE	PROGRESSIVE VERB	*going to/gonna*
344	432	95	113	48

Table 1: Counts of coded tokens by following constituent category.

3.2.3 Additional Independent Variables

Based on previous research on *is*-contraction (see Section 2.2), two further variables were also coded and included in statistical modeling: the length of the subject of *is* and the type of segment immediately preceding *is*. Subjects were segmented by the author and their length was measured in orthographic words. Preceding segments were automatically transcribed using the CMU Pronouncing Dictionary v.0.7b, or hand-transcribed by the author when a word did not appear in the dictionary, and then recoded as vowel versus consonant, following Labov 1969.

3.3 Modeling

Logistic regression was performed in R. Where possible, mixed-effects models with a random effect of speaker were fit using the `lme4` package, v. 1.1.12 (Bates et al. 2015). Where mixed-effects models failed to converge, fixed-effects models were used. Given that the average number of tokens per speaker in the data set is fewer than 3, and no speaker contributed more than 18 tokens, individual speakers are not likely to be heavily biasing the results.

4 Results

Because the question under study is whether the effect of following constituent category on *is*-contraction is mitigated the less likely the following constituent is to have been planned, I first examine the effect of following constituent on its own, before turning to its possible interaction with the planning proxy.

4.1 Following Constituent Category

A mixed-effects logistic regression model with fixed effects of log(subject length), preceding segment type, and following constituent category, and a random effect of speaker, returns the coefficients for the five different following constituent categories plotted in Figure 2. PROGRESSIVE VERB was set as the reference level, and all other categories, with the exception of PREPOSITIONAL PHRASE, turn out to differ significantly from it, at $p \leq 0.01$. There is no significant difference between PROGRESSIVE VERB and PREPOSITIONAL PHRASE ($p = 0.67$). The other independent variables included in the model behave as expected given previous research (subject length: β = -2.59, $p < 0.001$; preceding segment type=vowel: $\beta = 0.64$, $p < 0.001$).

The hierarchy of following constituent types on *is*-contraction in MAE thus roughly replicates that found for contraction and deletion in AAE, with *going to* favoring contraction, and ADJECTIVE PHRASE and NOUN PHRASE disfavoring it. Crucially, the data do not support a copula/auxiliary split, as has been suggested in earlier literature, as there is no significant difference between a following progressive verb (where *is* functions as an auxiliary) and a following prepositional phrase (where *is* functions as a copula). To confirm this, the data were also modeled with following constituent categories recoded as COPULA (NOUN PHRASE, ADJECTIVE PHRASE, PREPOSITIONAL PHRASE) vs. AUXILIARY (PROGRESSIVE VERB, *going to*). This model significantly differs from the model without the categories collapsed via a likelihood ratio test ($p < 0.001$); it also raises AIC (from 1241.5 to 1257.3) and BIC (from 1281 to 1282) compared to the uncollapsed model. We can thus confirm that following constituent type plays an important role in conditioning *is*-contraction in MAE, an effect which cannot simply be reframed as a difference between whether *is* functions as a copula or an auxiliary.

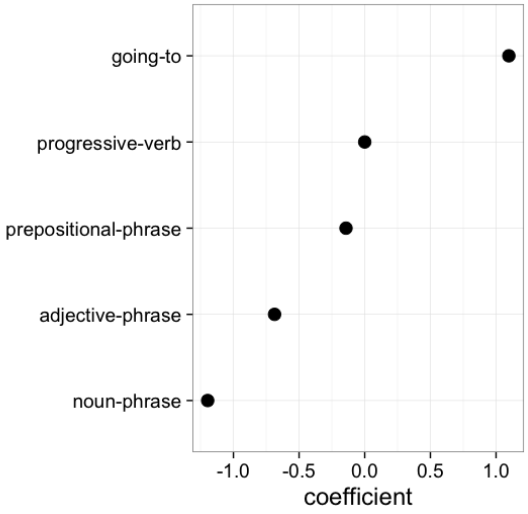

Figure 2: Coefficients for the effect of following constituent category on *is*-contraction from a mixed-effects logistic regression model (as described in the accompanying text). PROGRESSIVE VERB is the reference level.

4.2 Planning

Having established that there is a real effect of following constituent category on *is*-contraction, we can now turn to the question of whether this effect is mitigated when planning of that following constituent is likely to have been compromised.

As outlined in Section 3.2.1, the planning proxy used in this study was the duration of the word following *is*. Because duration of a word is naturally going to be influenced by the number of syllables in that word, and because the number of syllables per following word is not going to be the same across the five following constituent categories—for instance, with a following *gonna/going to*, the number of syllables will always be two—the data was pared down to only those tokens where the word following *is* was disyllabic. This left 334 tokens. Then, because there were only five tokens in this data subset with a following prepositional phrase—not enough to draw any meaningful conclusions from—following prepositional phrases were omitted, leaving 329 tokens for analysis. The breakdown of these 329 tokens by following constituent category is provided in Table 2. The small number of tokens in this analysis meant that only fixed-effects models could be fit to the data (mixed-effects models would not converge).

NOUN PHRASE	ADJECTIVE PHRASE	PREP. PHRASE	PROGRESSIVE VERB	*going to/gonna*
60	132	—	89	48

Table 2: Counts of coded tokens by following constituent category, subset of data with a disyllabic word following *is*.

Adding log(following word duration) to the logistic regression model enumerated in Section 4.1 (but with random effect of speaker removed) finds a strong negative effect of following word duration (β = -3.57, $p < 0.001$). This is visualized in Figure 3: contraction becomes less likely the longer the word following *is*. Other effects in the model more or less stay the same, though preceding segment type is no longer significant (β = 0.53, p = 0.093), and PROGRESSIVE VERB differs only from NOUN PHRASE (p = 0.003) and not from the other following constituent types.

This effect of following word duration, however, **does not** interact with the effect of following constituent type. Adding an interaction term does not return any significant results; the model with the interaction term is not found to be significantly different via likelihood ratio test from the model

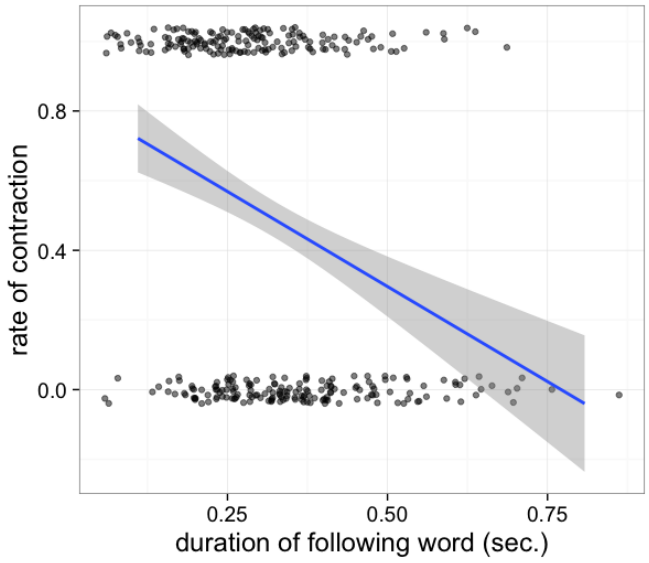

Figure 3: Contraction by duration of following word in seconds, disyllabic following words only.

without ($p = 0.2$), and the model with the interaction raises AIC (from 411.5 to 412.9). Our results thus differ from those in Wagner 2012 and Tanner et al. 2015: failure to plan (as measured by the planning proxy) does affect contraction rate, but does not change the effect on contraction of following constituent category.

5 Discussion

While previous researchers have found that the effect of a following phonological element is mitigated when advance planning is compromised, the present study does not find this when the following element is in the syntactic domain. I suggest that this may be attributable to the nature of advance planning at different levels of language. That is, it is possible that the syntax of the constituent following *is* has always, or almost always, been planned when a speaker goes to choose the phonological form of that *is*. By contrast, the phonology of a following segment may not always have been planned when a speaker goes to pronounce the *-ing* suffix, or to produce a word-final consonant cluster, thus resulting in the mitigating effects demonstrated by Tanner et al. (2015) and Wagner (2012).

Indeed, there is some support for this proposal. Sternberg et al. (1978) find latency times for speakers to begin reciting a prepared list to be sensitive to the number of words in the list, but not the number of syllables in the words, indicating that higher-level information may be available earlier in the planning process than lower-level phonological material. Moreover, Wagner et al. (2010), in a series of experiments testing the effect of cognitive load on list memorization, find that cognitive load hinders the retrieval of lexical items, but not the advance building of syntactic structure. The present results are compatible with these findings: if increased duration of the word following *is* can indeed be taken as a reliable proxy for hindered planning in some domain of language production, this hindered planning seems nonetheless not to interfere with the selection of the complement of *is* and its attendant effects on contraction.

Even setting aside the lack of an interaction with following constituent category, the finding that increased duration of the word following *is* results in less contraction of *is* is novel, and interesting. Again, if following word duration is truly a reliable proxy for planning, this means that contraction becomes less likely when people are not likely to have planned ahead. A possible explanation for this effect may lie in its connection with prosodic boundaries: as outlined in Section 2.1, a long following word may indicate the placement of a prosodic phrase boundary between *is* and that following word,

and in fact *is*-contraction is well-known to be blocked phrase-finally, as in (15).

(15) I wonder where the party is (*'s).

The effect of following word duration may be a probabilistic version of this same constraint. Future work, particularly in the experimental domain, where advance planning can be directly manipulated rather than inferred, should be able to shed more light on this.

6 Conclusion

This paper has investigated the effect of following constituent category on *is*-contraction, and whether this effect can be mitigating by advance planning failure. Though I find following constituent category to play a strong role in conditioning this variable, and though I also document a new, negative effect on contraction of the duration of the word following *is*, the two do not interact: the effect of following constituent does not change with increased following-word duration. That this result differs from what has been found for following phonological conditioning may stem from differences in advance planning scope at different levels of grammar.

A major caveat of this and related work is that speakers' advance planning is only inferred, not directly measured. Only with experimental manipulation—for instance, by giving speakers a cognitive load, or by manipulating the complexity of what they are saying—can we say with any confidence that we are disrupting their planning. Still, taking the results at face value, they support the proposal that psycholinguistic aspects of the language production system play a role in shaping the surface distribution of linguistic variants (Tamminga et al. to appear). This is an important methodological point for sociolinguists: if speakers are distracted, or their planning is otherwise compromised, it can affect the distribution of variants in their speech. And if, say, planning facility decreases with age, we may find different distributions of variants among older speakers purely for psychological reasons. This paper also underscores an important theoretical point: sociolinguistic variables are not only conditioned by the social and language-internal factors that are so familiar to us; like any other element of language we produce, they're also susceptible to the hardware of the language production system and its constraints, something which models of variability need to take into account. Overall, this line of research highlights the fact that we as sociolinguists can better understand our own variation data when we integrate insights from other fields that are also concerned with language production.

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