

Syntactic Effects on Variable Phonological Processes and the Locality of Production Planning

This paper presents the results of a production study looking at the influence of syntactic structure on variable phonological sandhi processes. The evidence suggests that at least the processes looked at here are in fact not constrained by syntax directly, but rather by the locality of production planning. The two processes under investigation in the experiment are t/d-deletion and sibilant assimilation in English (cf. Holst and Nolan, 1995), but this abstract only discusses results for t-deletion.

Phonological Factors in t/d-Deletion. The process of t/d-deletion is well-studied in the sociolinguistic literature (Labov, 1972, and many others). One important factor affecting the likelihood of t/d-deletion—apart from sociological ones—is the following phonological context. Across various dialects, the finding is that t/d-deletion is more likely when a consonant follows than when a vowel or a pause follows. Some studies found a higher rate of deletion if a vowel follows than when a pause follows, and others found a higher rate of deletion preceding a pause than when a vowel, this may in part vary by dialect.

The Influence of Syntax. While a pause is more likely to follow when there is a syntactic juncture, earlier studies have not directly tested for an effect of syntax on the rate of t/d-deletion, or tried to tease apart effects a following boundary and direct syntactic effects. Syntax might have a direct effect on t/d-deletion, at least if current ‘localist’ theories of syntax/phonology that interleave syntactic structure building and phonological structure building are correct, e.g. Stratal OT Kiparsky (2000) or Distributed Morphology (e.g., Bobaljik, 2000; Embick, 2010). The assumption is that structure is built cyclically, and the phonological content of material of a cycle that is not yet built (for example the phonological material in the next clause) should not be available to affect phonological processes. On the other hand, ‘globalist’ theories such as standard OT do not rule out the possibility that phonological information from different clauses or sentences would exert an influence, instead any locality would have to be built into the particular constraints and their ranking in an ad hoc way. We ran a production study looking at t/d-deletion and sibilant assimilation to test these predictions.

The Locality of Production Planning. Our own hypothesis about locality differs from those made both by localist and globalist theories. T/d-deletion is sensitive to whether a consonant or a vowel follows, but we predict that phonological environment exerts its influence *whenever it is available* at the time that the target word is being planned. In other words, the apparent locality effects by syntax or prosodic phrasing would then be expected simply as the consequence of the locality of production planning. The environment can therefore be stated as a segmental environment, but its presence or absence is affected by factors such as the strength of the following boundary. The strength of a boundary in turn reflects to what extent the upcoming word was available already at the point the target word was planned. Syntax affects prosodic phrasing and hence production planning, but, the hypothesis is, itself has no effect on its own. A production planning account can also explain why it is that (at least so called postlexical) phonological processes are sensitive to speech rate (Kaisse, 1985), which is not incompatible with localist and globalist theories but they do not predict the observed variability or the speech rate effects.

The Experiment. Participants were asked to produce sentences that involved a non-

word which ended in a [t]. The sentences varied along two dimensions: First, when the following word was in the same or in a separate sentence; second, whether the following word began with a vowel or with a consonant. We constructed 8 quadruplets of the following form, varying the place of the articulation of the following consonant (if there was one) between voiced and voiceless velar and labial stops:

- (1) a. If you plit, Alice will be upset.
- b. If you plit, Penny will be upset.
- c. If you plit Alice, John will be upset.
- d. If you plit Penny, John will be upset.

Methodology: We recorded 20 native speakers of English producing 32 sentences each, varying between the 4 conditions. Participants were asked to record each sentence twice, once with a normal speech rate, and once with a fast speech rate. The stimuli were pseudo-randomized such that we could analyze the experiment as latin-square by only looking at the first 8 trials for each participant. This way, we could test whether the recurrence of similar sentences had any effect over the course of the experiment. The latin-square-analysis of the subset of the data didn't lead to any difference in effects compared to the full data set. The results we report here are based on the complete data set. Each soundfile was annotated by an RA (unaware of the hypothesis of the experiment) for whether or not t-deletion had taken place. A more in-depth acoustic annotation of the presence/absence of glottalization and the presence/absence of a release of the final [t] is in progress.

Results and Discussion: A logistic mixed-model analysis with syntax and phonological environments as factors and item and subject as random-effects and a full random slope structure found a main effect of phonology on t-deletion ($p < 0.001$), and also an interaction such that phonology exerted a smaller influence across a syntactic boundary ($p < 0.01$). This is *prima facie* as expected under a localist theory. However, the phonological effect was significant even when the following word was in a separate sentence, so contrary to the predictions of localist theories there was *some* effect of phonology, even if a smaller one. The pattern is as expected if the phonological effect of the segmental environment is constrained by the locality of production planning. Moreover, under a fast speaking rate, while the phonological main effect was there ($p < 0.001$), there was no interaction between syntax and phonological environment ($p < 0.52$). This speaks against the hypothesis that the interaction between syntax and phonological environment observed under a normal speaking rate is a direct consequence of syntactic locality. Rather, it lends further support to the view that the locality of production planning constrains this sandhi process.

Conclusion. In sum, the results are as predicted by the view that the phonological effects on t-deletion are constrained by the locality of production planning. The effects of syntax on t-deletion are not direct but are mediated by the effect of constituent structure on prosodic phrasing, which in turn reflects planning chunks. A similar analysis of the sibilant assimilation data is in progress.