

Undershoot in intraspeaker variation

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Intraspeaker stylistic variation at the phonetic level is well documented with acoustic methods. In particular, formant frequencies of vowels are often reported to show socially-meaningful variation between careful or slow speech and faster speech (Labov 2001, Beckford Wassink 2001).

In fast speech, vowels tend to have shorter durations. Laboratory phonetic studies have shown durationally-short vowels to be more susceptible to *undershoot*, the assimilatory effect of surrounding consonants. For example, when a back vowel (characterized by a low F2) is surrounded by velar consonants, the vowel's F2 onset and offset are raised relative to the midpoint; this effect is magnified when the vowel is too short to ever reach its low F2 target (Lindblom 1963; Moon & Lindblom 1994; Beckman et al. 1992).

Although the influence of surrounding segments on vowel formant frequencies is well known in sociolinguistics, the duration-dependent nature of undershoot is not generally considered in sociophonetic studies of stylistic variation. As a result, intraspeaker differences in formant frequency across contexts may be incorrectly identified as socially-motivated style shifting when they are in fact undershoot effects, i.e. purely phonetic.

This paper investigates undershoot as it interacts with stylistic variation. In a previous case study we conducted, a complex pattern of intraspeaker variation emerged: in two interactional settings, /o/-fronting and /ae/-retraction, variables shown to carry local and supra-local social meanings in American English, were found to correlate with separate aspects of the speaker's race-, class-, and sexuality-based identity performances. In this study, we revisit our previous work with data from two additional interactional settings with that speaker in order to determine whether his observed /o/-fronting and /ae/-retraction result from social motivation or from the effects of undershoot. Formant measurements were taken from FFT spectra every 10 ms using Praat 4.2.34 (Boersma & Weenik 2005) and Akustyk 1.7.7 (Plichta 2006). Mean F2 for each token was used for statistical analysis (N = approximately 80 per vowel). Vowel durations were measured to the nearest 1 ms.

Via linear regression analyses, we find evidence of co-occurring social and undershoot effects. Our previous finding of socially-motivated variation is supported: interactional setting significantly correlates with F2 for both /o/ ($p < .01$) and /ae/ ($p < .05$), independent of duration and phonetic environment. We also find a slight undershoot effect for /o/, as predicted by Moon & Lindblom (1994), based on the interaction between duration and phonetic context. Unexpectedly, however, we find no undershoot effect for /ae/, even though preceding phonetic context is significant ($p < .01$). This finding, we contend, results in part from substantial differences between the controlled (laboratory) conditions common to previous investigations of undershoot and typical sociolinguistic conditions (e.g., overall faster and noisier speech). Modified methods and expectations for investigating undershoot in non-controlled data are proposed.

While augmenting existing sociophonetic evidence that linguistic resources contribute to multi-faceted identity performance, our results also demonstrate the potential for undershoot effects in intraspeaker data. Accordingly, we propose the need to account for undershoot effects in sociophonetic research, as they may otherwise erroneously be identified as style shifting.

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