SOCIALLY CONDITIONED CHANGE IN VOICED STOP CONSONANTS IN APPALACHIAN CHILDREN

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ABSTRACT

Sociophonetic work on consonantal variation in American English (AE) has reported regional and social influences on phonetic realization of voiced stop closures. In particular, adult speakers of Southern AE exhibited greater extent and magnitude of voicing than speakers of mainstream varieties, reflecting their strong community ties and common beliefs, with no evidence for sound change in apparent time. We hypothesized that the sound change could originate in children, who would suppress the excessive voicing as a marked feature associated with the regional Southern twang. Variation in the extent of voicing in voiced stop closures was analyzed acoustically in school-age children born into local families in a small Southern Appalachian community, relative to matched mainstream AE controls. No significant differences were found between the two groups. However, a non-significant trend included greater frequency of fully voiced closures in the Appalachian children, reflecting the speech of the older speakers in this community.

Keywords: sociophonetics, consonants, voicing, American English, regional dialect.

1. INTRODUCTION

It has been well established that differences in vowel production constitute the most salient variable that divides American English (AE) into regional varieties spoken in geographically defined dialect regions [11,12]. Given the predominant focus on vowels, consonantal variation has received comparatively less consideration and instrumental sociophonetic studies are still scarce (see the review in [23]). Especially little is known about regional variation in the production of stop consonants. This is a surprising gap, considering that socially based variation in specific properties of stops such as voice onset time (VOT) or glottalization was intensely studied and documented in other varieties of English including British and Scottish English [6,7,21,22].

Several recent sociophonetic studies reported, however, that heritage languages and regional influences do condition the realization of stops in AE. To that end, a distinct pattern of cueing the voicing contrast in word final position (i.e., partial neutralization) was found in Wisconsin (WI) across several generations of Americans living in historically German American communities [18,19]. Another study reported an unexpected pattern of regional variation in voiced stop closures in the intersonorant position [10]. In particular, middle-aged women in a Southern Appalachian community in western North Carolina (NC) produced stops with fully voiced closures compared to a corresponding group of women from WI, whose stop closures were only partially voiced. The WI productions reflected a typical realization of voiced stop closures in AE, consistent with the predictions of the breath-stream control mechanism model [24], whereas the Southern productions were markedly different, suggesting involvement of an active mechanism that facilitated the continuation of voicing during the closure.

Consistent with [10], the heavy voicing during voiced stop closures in the intersonorant position was also found in speakers of Southern heritage residing in three different communities in Inland California (CA) [16]. Southern dialect features are prevalent in California's Central Valley owing to an earlier migration of settlers from several Southern states in 1930s. Analyzing spontaneous productions of women and men ranging in age from 19-90 years, the study found that people who earned their living off the land (e.g., those involved in farming, ranching, logging or other forms of land-based industries) had significantly stronger voiced stops (measured as intensity of voicing during the closure) than those who did not. Importantly, speaker age (i.e., suggestive of sound change in apparent time), sex or education had no significant effects on the magnitude of closure voicing. Rather, the voicing pattern was associated with the values of land-oriented communities in CA, suggesting that social factors can underlie regional variation in voiced stops.

Intrigued by these findings, the current study further inquired into the patterns of regional variation in the realization of voiced stops in the intersonorant position. According to [16], there was no indication of age-related change (i. e., sound change in apparent time) in the closure voicing pattern in people who earned their livelihood off the land. However, the youngest speakers in the CA sample were 19 year-old

adults who were able to interpret the indexical meaning of this phonetic feature through their economic ties to the land. We conjectured that change in the production of closure voicing can be manifested in children rather than in adults due to apparent child-adult differences in interpretation of socio-cultural contexts.

We previously tested a related hypothesis in school-age children in the two communities in NC and WI studied in [10]. Our particular interests were in the Southern Appalachian children who were growing up in a culturally changing small-town community, as the region has opened up to influences of mainstream American socio-cultural norms. These children were termed the "in-between" generation thanks to their distinctive vowel productions [9]. In particular, they created new intermediate phonetic forms that have reflected their accommodation to the changing environment, and indicated both their belonging to the local area and their approximation of forms used in the mainstream American society.

Of relevance, the Appalachian children rejected the monophthongization of the diphthong /ai/ in pre-voiceless contexts, the most archaic Southern feature, possibly as being old-fashioned and associated with older local speakers. We conjectured that they will also have rejected the "heavy" voicing in voiced stops as manifesting the stereotypical Appalachian *twang*, a distinct manner of speaking associated with rural regional identity. In recent years, the meaning of the term *twang* has been explored in perceptual dialectology research as indicating differences among AE varieties [17]. In the context of the American South, it was concluded that "twang is associated with linguistic features and social meanings salient in perceptions of the Southern speech in American English, including perceptions of the social personae of rural white Southerners" [20, p. 396].

Given the evidence of suppression of locally marked variants in vowels [9], we hypothesized that the Appalachian children will have also suppressed the extended voicing in stop closures. Presumably, the "less sonorous" voiced stops will have had the appeal of mainstream America, indicating children's departure from the regional *twang*. Our hypothesis will be supported if no significant differences were found between the productions of the Appalachian children and children representing a variety of mainstream AE spoken in WI.

2. METHODS

2.1. Participants

Twenty children, all girls, ranging in age from 8-12 years, participated. Ten were born into and raised by local families rooted in the Appalachian region of western NC in Jackson and Haywood counties, and 10 were from the Madison area in south-central WI. All were typically developing children, attended local schools, and none had undergone speech-language therapy in the past. All were fluent readers, which was a prerequisite for their participation in the experiment.

2.2. Speech materials

Speech materials were as in [10]. The target words were *bits/bids*, *bets/beds*, *bats/bads*, *baits/bades*, *bites/bides* and occurred in sentential context of the type: *Doc said the LARGE bats are fast. No! Doc said the SMALL bats are fast*. The main sentence stress (capitalized for the reader) was varied systematically so that each sentence pair was read in five different ways, conditioned by the emphatic stress. For the analysis of voiced stops in the target words, three emphasis levels were selected (high, intermediate, low) as representing variation in speech. Examples: **High:** *Rob said the tall CHAIRS are warm. No! Rob said the tall BEDS are warm*. **Intermediate**: *Rob said the SHORT beds are warm. No! Rob said the TALL beds are warm*. **Low:** *Rob said the tall beds are COLD. No! Rob said the tall beds are WARM*.

In the second sentence in each pair, the stop /b/ always occurred in the intersonorant position, at the juncture of two words (e.g., *tall **b**eds*). To control for the degree of velarization of /l/, only words with open back vowels were used (*small, dull, fall, tall*). Each sentence pair was displayed (randomly) on a computer screen and read by the child. A short practice was administered prior to the experiment to ensure that the child was able to do the task. Only the stop /b/ in the second sentence was analyzed for a total of 30 productions obtained from each child.

2.3. Acoustic measurements and measures

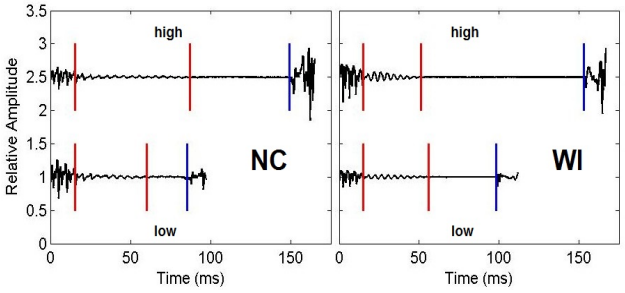
Acoustic measurements included word onset, word offset, stop closure onset (which was the same as word onset), closure release, voicing offset during closure, and voicing onset for the vowel. These landmarks were located by hand from the waveform using TF32 software package [15]. From these output values, several acoustic measures were then computed with MATLAB [13], including word duration, closure duration, and the extent of closure voicing measured as both closure voicing duration and the proportion of closure voicing.

3. RESULTS

Figure 1 exemplifies variation in stop closure voicing (here, the /b/ in *small **b**aits)* under high and low

emphasis in one NC girl and one WI girl. The waveforms are time aligned and include a 15-ms interval preceding the stop closure, the stop closure itself (the time interval between the first red and the blue mark), and a 15-ms interval that follows the stop closure release. We observe that all closures are partially voiced. The extent of voicing (the time interval between the two red marks) appears greater for the NC child than for WI child.

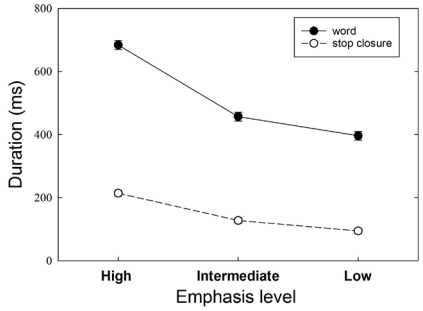
Figure 1: Waveforms of partially voiced closures



3.1. Word duration and stop closure duration

We first considered the durations of the target words and the stop closures, fitting separate linear mixed-effects models to each variable. The statistical analyses were carried out in SPSS v. 25 [8]. For each dependent variable, a baseline model only included the intercept; dialect, emphasis level, final consonant (-d, -t) and their interactions were entered as fixed effects using forward selection. Participant was a random effect. The significance of the fixed effect was determined with likelihood ratio tests. Vowel quality was not included in the models because its effects were not of immediate interest to the study.

Figure 2: Average (s.e.) word and closure durations



The analysis of word duration failed to show an effect of dialect (χ^2 (1) = 1.33, p = .250). The main effect of emphasis was significant (χ^2 (2) = 555.1, p < .001). As shown in Figure 2, word durations decreased with each lower emphasis. Multiple comparisons indicated significant differences among all three levels (p < .001). The model was slightly improved by including an emphasis by dialect interaction (χ^2 (2) = 8.26, p = .020), which was due to significantly greater durations of high-emphasis words in WI.

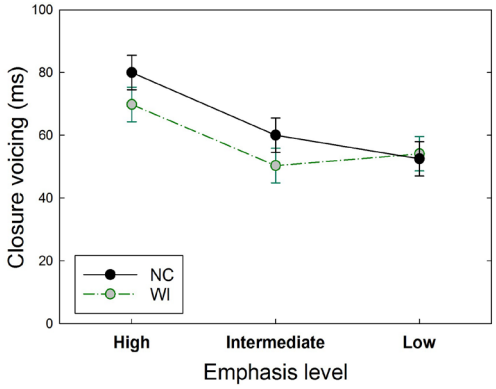
The corresponding durations of stop closure are included in Figure 2. The model for closure duration also failed to show an effect of dialect (χ^2 (1) = .29, p =.590). Emphasis was the only significant predictor (χ^2 (2) = 226.47, p < .001). As for the words, all pairwise comparisons were significant (p < .001).

Overall, the analyses of word and stop closure durations showed no temporal differences between productions of NC and WI children. Furthermore, both groups of children were successful in conveying temporal variations as a function of emphasis level.

3.2. Analyses of the closure's voicing

The average duration of voicing in closure was slightly greater for NC children (64.2 ms) than for WI children (58.1 ms). However, this difference was too small to reach significance (χ^2 (1) = .96, p = .330). The model also included the effect of emphasis (χ^2 (2) = 31.59, p <.001). For each dialect, the extent of voicing was greatest in the high-emphasis condition (Figure 3). Multiple comparisons showed that the low and intermediate levels did not differ significantly from each other (p = .653). No other main effects or interactions were significant.

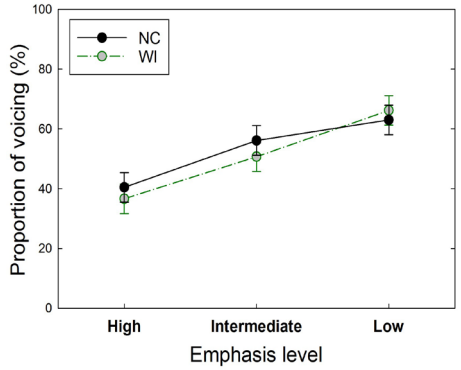
Figure 3: Average (s.e.) extent of voicing



Given the modest dialect-related differences for closure voicing measured in absolute terms, we also assessed the proportion of voicing (i.e., the duration of closure voicing relative to the overall closure duration). As shown in Figure 4, the relations among emphasis levels were now reversed and thus the proportion of voicing increased with each lower level.

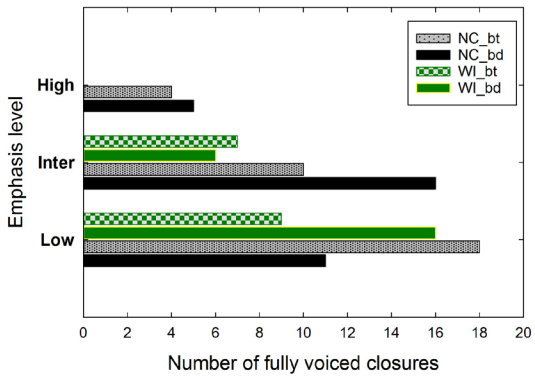
The model of the proportion of voicing yielded similar results: No significant effect of dialect (χ^2 (1) = .99, p = .320), and a significant effect of emphasis (χ^2 (2) = 96.84, p < .001). In this analysis, however, all pairwise comparisons were significant (p < .001).

Figure 4: Average (s.e.) proportion of voicing



Although the majority of the stop closures were partially voiced, we also inquired into the frequency of fully voiced closures in our sample. Only 17% of all closures were fully voiced, of which 10.7% were produced by all 10 NC children and 6.3% by 8 WI children. Figure 5 shows the frequency of fully voiced closures split by emphasis level and final consonant. We observe that, in the high-emphasis condition, only NC closures were fully voiced, and the fully voiced closures were also comparatively more frequent at the intermediate level. As expected, both groups produced the fully voiced closures mostly in shorter non-emphatic (unstressed) words.

Figure 5: Frequency of fully voiced closures



4. DISCUSSION AND CONCLUDING REMARKS

Based on the previous reports of diachronic vowel change in the Appalachian community in western NC [9], we hypothesized that sound change can also be manifested in consonant productions. The current study found that children in this community indeed suppressed the marked local variant of a "sonorous" voiced stop. Unlike the fully voiced stop closures in older generations [10], the children's closures were only partially voiced and, along with the other associated variables, did not differ significantly from mainstream AE productions of children in WI.

Although this is a small-scale study and only considers one stop /b/ in the intersonorant position, this type of variation has proven relevant in sociophonetic research [10,16]. Of importance is that all children were born and raised in the area and came from families representing several generations of local Appalachians, which secured their exposure to the regional *twang*. We underscore the non-significant trends in children that are reminiscent of the older speakers in the community: The extent of their closure voicing was still greater than in WI children and their fully voiced closures were comparatively more frequent. Possibly, these non-significant trends signal greater frequency of fully voiced closures in free conversations, and perhaps a greater overall strength of voicing that can emerge in spontaneous speech [16]. Future research will verify these possibilities.

Focusing on regional variation in the production of /b/, we assume that the older children studied here have already acquired the voicing contrast in stop consonants. Given the recent evidence from 27 languages that most consonants are produced correctly by the age of 5 [14], it is unlikely that the patterns of variation in /b/-production found in this study can be attributable to incomplete development. However, the results do provide evidence for the mastery of linguistically meaningful control of emphatic stress in these children, acquisition of which may continue past the age of 7 [1]. In particular, the significant effect of word emphasis on the proportion of stop closure voicing (all pairwise comparisons were significant) indicates that both NC and WI children were able to vary their productions of /b/ in a systematic fashion, even if still reading more slowly than the adults (mean word duration for all children was 513 ms relative to 443 ms for adults in [10]).

Finally, the current study justifies the scientific inquiry into sociophonetics of the consonantal variation in AE. Admittedly, an important body of recent phonetic work began to investigate patterns of variation in realization of stops in AE, both within and across talkers, in structured and spontaneous speech, and taking into account the phonetic effects of surrounding context, word and phrase position, variation in lexical stress and speaking rate [2-5]. However, while insightful and breaking new methodological grounds, these studies explored variation in talkers coming from a range of dialect backgrounds and were not concerned with consonantal variation and sound change in a particular regional variety or speech community. Situating these explorations in sociophonetic contexts may lead to the emergence of new loci defining regional variation in AE. Supported by additional evidence, the true voicing of voiced stops studied here has a potential to become one of them.

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