ACOUSTIC CHARACTERISTICS OF CLOSING DIPHTHONGS IN BAHAMIAN CREOLE

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ABSTRACT

Reporting the results of an acoustic analysis of closing diphthongs produced by 15 speakers of Bahamian Creole, this paper links phonetic features with variation in social class. The inventory analysed includes four vowel categories, represented by the lexical sets CHOICE, NURSE, MOUTH, and PRICE. In addition to the extent of spectral change in F1/F2 space, the relative position of the diphthong onsets was investigated. The findings reported here complement earlier impressionistic accounts and extend our understanding of the phonetic variation to be found within the Bahamian creole continuum.

Keywords: Bahamian Creole, Caribbean, social variation, acoustic analysis

1. INTRODUCTION

1.1. Bahamian Creole and Bahamian English

Bahamian Creole (BahC) is spoken by about 250000 speakers in The Commonwealth of The Bahamas. It is the mother tongue of the majority of Afro-Bahamians, who account for about 90% of the total population [6], while the nation's official language is English. The roles that standard English and BahC play in Bahamian society must be seen in the context of the development of other anglophone countries in the Caribbean from British colonial societies to independent nations and a culture strongly influenced by North America. BahC differs from other Caribbean varieties, however, in the fact that it did not evolve on Bahamian soil, but originated from an 18th century North American import, an earlier form of the creole language Gullah [12, 11]. Today, the Bahamas is a place of great linguistic diversity, internally as well as with regard to competing external influences. With continued migration to the cities, New Providence, the site of the nations capital Nassau, is now home to about 70% of the total population [6]. The urban variety of BahC can therefore be regarded as most representative of the creole at large and will be the focus of the present study.

1.2. Previous accounts of BahC closing diphthongs

Despite its interesting linguistic ecology, BahC has not received the attention of other more 'typical' Caribbean creoles. This is especially true for aspects of phonetics and phonology, which are a "Cinderella of creole studies" [20] in general. The first systematic description of Bahamian vowels is found in John Wells [27]. Another early source is Holm and Schilling [14], which contains a rough pronunciation guide of words in "relaxed Nassau speech" (vii). The most recent account of Bahamian vowels and their lexical incidence is presented in Childs and Wolfram [5], who include information derived from an auditory-acoustic study of accommodation patterns in white and black speakers from Abaco, a small island to the northeast of New Providence [4]. Other more cursory accounts of individual vowel sounds can be found in [21], [13] and [7]. The nature of the available source materials is rather heterogeneous, as different regional, social and ethnic varieties are not distinguished consistently. Some authors consider variation on the basilect-acrolect continuum more relevant for morphosyntactic features and are therefore reluctant to describe phonological variation along this dimension (e.g. [5]). While it may be true that it is difficult to draw a fundamental distinction between dialectal and creole varieties based on phonetic and phonological properties [19], this does not imply that creole speech communities have only one invariant model of pronunciation. Phonologies can vary considerably depending on the speakers' position on the continuum of lects, as research on Jamaican Creole (e.g. [16, 1]) demonstrates. Although phonological variables tend to show fine rather than sharp stratification [18], which characterises many morphosyntactic properties of creoles, it is thus necessary to address the added dimension of social variation when discussing aspects of creole phonology.

All of the above authors agree that the vowels in CHOICE, NURSE, MOUTH and PRICE are typically produced as closing diphthongs in BahC (table 1). Diphthongised NURSE is a striking fea-

ture of BahC, a "true marker" ([7]: 22) that is replaced by standard [ɜː] only in acrolectal speech. Although BahC is traditionally a non-rhotic accent, r-full pronunciations prevalent in North American speech are increasingly perceived as standard. The effect, however, is considered to be stronger on Anglo- than on Afro-Bahamian varieties [5]. There is some disagreement as to how similar productions of CHOICE and NURSE really are and how similarity is achieved. While Wells [27] proposes that realisations of NURSE approach and merge with those of choice, Holm and Shilling (HS) [14] suggest that, in the speech of the "less educated", both diphthongs vary socially. Childs and Wolfram (CW) [5] finally propose that productions of nurse may approximate those of CHOICE, but the diphthong onset of the former never reaches the same backed position. Closing diphthongs in NURSE have not been attested in other Caribbean creoles, but they used to occur in the Southern white speech of coastal North America from South Carolina to Texas, where they have become stigmatised and are now obsolete [23]. Holm [13] mentions that the feature has been found in Gullah, which might explain its presence in BahC, but other sources (e.g. [22], [26]) indicate monophthongal realisations.

Table 1: *Suggested vowel qualities.*

Lexical set	Wells [27]	HS [14]	CW [5]
CHOICE	ɔɪ	ʌɪ ~ ɔɪ	ɔi
NURSE	ɔɪ ~ ɜː	ʌɪ ~ ʌ	ɔi ~ ɜ
MOUTH	ɑʊ	aʊ	aɔ ~ ɑɔ
PRICE	ʌɪ	aɪ	ai ~ ɑi

The vowels in words like PRICE and MOUTH are generally described as fairly standard, high-front or high-back gliding diphthongs. Some authors have noted monophthongal productions of PRICE in prevoiced contexts [5], exhibiting a pattern similar to that found in African American Vernacular English, or of both PRICE and MOUTH in more basilectal speech [21]. Holm [13], however, argues that this phenomenon is confined to certain islands and otherwise as rare in the Bahamas as it is in the rest of the Caribbean. At least for non-creolised Bahamian varieties, it has also been suggested that the allophones of MOUTH and possibly of PRICE follow the rules of "Canadian Raising" [24], whereby the nucleus is raised to mid height before voiceless consonants [3]. While evidence of pre-voiceless raising can be found in many North American varieties from Canada to coastal South Carolina and Georgia (see [15]: 40), where it variably affects the nuclei of either or both MOUTH and PRICE, it has not been observed in any of the Atlantic creole languages. In some Caribbean varieties and in Gullah the nuclei in MOUTH may be raised to [ʌ ~ ɔ] irrespective of the phonetic context, but so far no evidence of nuclear raising has been attested in the Bahamian context, voice-conditioned or otherwise.

The aims of the present study are to provide a first acoustic description of the raising diphthongs of urban BahC. The diphthongs will be analysed with a view to realisations and social distribution patterns proposed above. It is expected that diphthongisation of NURSE, being a conspicuous non-standard feature of BahC, will show clear social variation and it will be assessed whether varying realisations of CHOICE may contribute to the perceived similarity of the diphthongs. Previous impressionistic descriptions of MOUTH and PRICE are extremely varied with suggestions ranging from invariant or voice-conditioned monophthongisation to Canadian Raising. The present study will analyse which of the suggested variants are reflected in the participants' productions and whether differences in social class are able to account for these diverse accounts.

2. METHODS

2.1. Speakers and materials

The speakers analysed are a subset drawn from the tape-recordings of free conversations with 20 Nassauvians that Stephanie Hackert conducted in 1997/98 as part of her research on past temporal reference in urban Bahamian Creole [10]. In order to assign participants to different social classes, a classification scheme based on occupation was adopted, originally devised for the Jamaican context [9]. The result is a broad three-way distinction: the 'middle strata', the 'petite bourgeoisie' and the 'working class'. The selection of speakers for the present study was mainly driven by the availability and quality of recordings. The final sample contained six working-class speakers and four middle-strata or petite-bourgeoisie speakers, who were combined to form the category of higher-class' speakers. All participants were black. The age of participants ranged from 25 to 70 at the time of recording and both genders are represented.

2.2. Data analysis procedures

The recordings were digitised at 20 kHz. Mono- or disyllabic word tokens pertaining to the lexical sets under investigation were manually marked and extracted. Where possible, at least 10 tokens were collected for each vowel, with no more than two to-

kens of the same wordform. Pre-nasal and pre-liquid contexts were avoided as well as tokens following /r/ or semivowels. For MOUTH and PRICE, only VC contexts were considered. Realisations of both CHOICE and NURSE showed to be extremely sensitive to the preceding consonantal context, which was therefore confined to labials and coronals.

Segmentation and acoustic measurements were carried out using the Praat software [2]. The onset of a vowel was determined from the waveform and set at the first regular pitch pulse. The offset was marked at the last regular pitch pulse or at the point at which the complex wave smoothed. In ambiguous cases, the spectrogram was consulted to determine the point of diminishing F2. Measurements were made in a semi-automatic procedure using linear predictive coding (LPC). Parameters were initially set to the Praat default, though the LPC order was adjusted in some cases to improve formant readings. F1 and F2 measurements were taken at 10% intervals through the vowel and confirmed or corrected by visual inspection. Formant estimates were then saved to file and further processed in the R environment [17].

In order to avoid the problematic inter-speaker comparison of acoustic data in raw Hertz values, formant frequencies were converted to Bark and then normalised using a formant intrinsic centroid-based technique developed by Watt and Fabricius [25, 8]. The extent of gliding movement for all diphthongs was quantified by calculating the vector length of overall spectral change in F1/F2 space, defined as the Euclidean distance between nucleus and glide. For MOUTH and PRICE, nucleus and glide were defined as the point of maximum F1 between 20% and 40% into the vowel and as the point of maximum/minimum F2 between 80% and 90%, respectively. For CHOICE and NURSE, nucleus and glide were set to minimum F2 between 20% and 40% and to maximum F2 between 80% and 90%. Following the procedure adopted by Moreton and Thomas [15], the relative position or pre-voiced and pre-voiceless tokens of MOUTH and PRICE was assessed by direct comparison of the two phonetic contexts. The voicing effect on the nucleus was quantified for each speaker and formant as the log ratio between the mean for all voiceless and the mean for all voiced tokens. The position of the nucleus of NURSE relative to that of CHOICE was determined in an analogous procedure by calculating for each speaker and formant the log ratios between the mean of all NURSE tokens and the mean of all CHOICE tokens.

3. RESULTS

3.1. CHOICE and NURSE

All speakers realise CHOICE as a long back-to-front gliding diphthong and display monophthongal productions for NURSE after coronal consonants (see figure 1, left). While working-class (w-c) speakers, however, show shorter vector lengths for CHOICE than higher-class (h-c) speakers, their productions for NURSE are more diphthongal. Following labial consonants, both diphthongs tend to be characterised by more spectral change than in post-coronal contexts, and w-c speakers produce similar vector lengths in post-labial NURSE and post-coronal CHOICE tokens. Due to the overall scarcity of tokens, statistical tests were conducted for post-labial tokens only. A repeated-measures ANOVA on vector length with lexical set as within- and social class as between-speaker variable revealed a significant effect of lexical set ($F[1,13]=49.1$, $p<0.001$) and significant interaction between the two factors ($F[1,13]=12.6$, $p<0.01$).

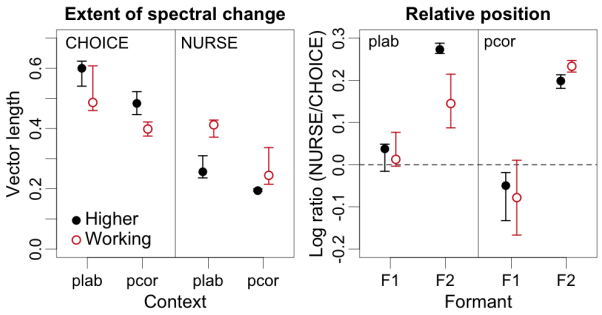

Figure 1: *Extent of spectral change from nucleus to glide by preceding context (left) and log ratios NURSE/CHOICE at nucleus by formant (right): Median values and interquartile ranges.*

The speakers' results for the log ratios calculations are displayed in the right plot in figure 1. Positive log ratios indicate lowering (F1) or fronting (F2) of the nucleus in NURSE compared to CHOICE. A log ratio of zero implies lack of difference in the position of the nuclei. While differences in the F1 dimension do not appear to be extensive, the nucleus in NURSE is clearly more front in all contexts, if somewhat less so for post-labial tokens in the speech of w-c participants. A repeated-measures ANOVA showed this class difference to be significant ($F[1,13]=6.1$, $p<0.05$).

3.2. MOUTH and PRICE

MOUTH and PRICE are realised by all speakers as high-back and high-front gliding diphthongs,

respectively. While for w-c speakers the spectral change from nucleus to glide is on average longer in pre-voiced than in pre-voiceless contexts, the reverse is true for h-c speakers (see figure 2, left). Due to the small token number in MOUTH, only measures of PRICE were subjected to a repeated-measures ANOVA with voice setting as within- and social class as between-speaker variable. The results confirm a significant interaction between the two factors ($F[1,13]=8.8$, $p<0.05$).

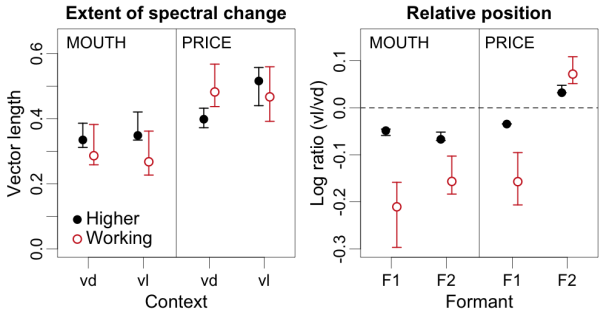

Figure 2: *Extent of spectral change from nucleus to glide by voicing of following consonant (left) and log ratios pre-voiceless/pre-voiced at nucleus by formant (right): Median values and interquartile ranges.*

The most obvious difference between the productions of w-c and h-c speakers, however, is not the overall extent of gliding movement, but the relative onset position of the diphthongs. The calculated log ratios are displayed in the right plot in figure 2, where negative values indicate raising (F1) or backing (F2) and positive values lowering (F1) or fronting (F2) in pre-voiceless relative to pre-voiced contexts. The raising and backing of the nucleus in pre-voiceless MOUTH and the raising and fronting in pre-voiceless PRICE, while present to some degree in both social groups, is more pronounced in the productions of w-c speakers. Repeated-measures ANOVAs conducted on the F1 and F2 log ratios of PRICE with social class as between-speaker variable showed a significant effect of class for the first ($F[1,13]=15.9$, $p<0.01$) but not for the second formant ($F[1,13]=4.0$, $p<0.07$).

4. DISCUSSION

The results of the acoustic analysis of (potential) closing diphthongs showed that social variation with regard to phonetic features is clearly present in the urban BahC speech community. Diphthongal productions of NURSE showed the expected direction of variation, with w-c speakers producing longer glides than h-c speakers. CHOICE also varied across social class, exhibiting less spectral change for w-c speakers. At least in post-labial contexts, the nuclei of CHOICE and NURSE approach each other in the speech of w-c participants. These findings indicate that both CHOICE and NURSE participate in social variation, resulting in more similar realisations among w-c speakers. However, while certain place-conditioned allophones may show sporadic overlap, the diphthongs are clearly not merged.

Variation in MOUTH and PRICE revealed an interesting pattern. Working-class speakers exhibited considerable raising and backing/fronting of the nucleus in pre-voiceless tokens, but they did not produce weakened glides in tokens before voiced codas; on average, the gliding movement was even shorter in pre-voiceless contexts. In contrast, h-c speakers showed only marginal adjustments of nucleus position in pre-voiceless compared to pre-voiced tokens, while realisations of MOUTH and PRICE in pre-voiced contexts were characterised by a shorter gliding movement, even though none of the speakers produced monophthongal tokens. The findings, thus, indicate that w-c speakers exhibit a voice-conditioned allophony consistent with the alternation commonly referred to as Canadian raising, while h-c speakers show signs of incipient glide weakening. Moreton and Thomas [15] argue that voice-conditioned nuclear raising and glide weakening are actually related processes. They reflect a universal phonetic tendency to promote assimilation of the nucleus to the glide before voiceless contexts, while the nucleus dominates the glide before voiced contexts. Continued influence of the assimilatory pressures on the allophones would eventually modify them further, which might explain why certain dialects exhibit Canadian raising and others glide weakening or monophthongisation. The variation found in MOUTH and PRICE in the data for the present study is not linguistically contrastive and the extent of glide weakening may not be consciously perceived. However, the significant differences between social classes show that it cannot be considered merely a consequence of articulatory constraints.

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