Quantifying Prosodic Variation in AAE as a Function of Gender and Interlocutor Using the PoLaR Framework

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ABSTRACT

While African American English (AAE) is well-documented, descriptions of its prosody remain scarce. This study is the first phonetic paper to describe the prosody of AAE speakers using the PoLaR framework, which represent a flexible framework for describing prosodic variation. This study examines data from 29 AAE-speaking students with attention to variation by speaker gender and interlocutor. Data was annotated and extracted using PoLaR and a series of regression models then tested differences between speaker groups by number of points, level and range changes. Results indicate female speakers use wider pitch ranges and more dramatic local F0 changes than male speakers. Additionally, speakers are sensitive to interlocutor; those who interacted with an AAE-speaking interlocutor used greater level changes, more points, and wider pitch ranges. These results demonstrate the utility of PoLaR for describing prosodic variation in English, and document the role of gender and interlocutor in prosodic variation in AAE.

Index Terms: prosody, sociophonetics, African American English, ethnolinguistic variation, PoLaR

1. INTRODUCTION

Though African American English is extremely well-documented in the sociolinguistic literature, descriptions of its prosody remain scarce. Previous works have explored the variety's pitch accent inventory and distribution as well as boundary tones using MAE-ToBI annotations based on the AM framework, without attention to the fact that these conventions were not designed to accommodate variation in American English [1, 2, 3] (see section 1.1). The current study is the first phonetic paper to describe the prosody of AAE speakers using the PoLaR conventions developed by Ahn et al. 2021 [1], which may represent a more flexible framework for detailing such variation. This study is an examination of reading data from 29 AAE-speaking college students with special attention to variation conditioned by speaker gender and interlocutor. The aims of the paper are to test a new methodology for describing the prosodic system of a non-mainstream variety of American English, taking into account phonetic variables, as well as to better describe sociolinguistic factors that may contribute to intra-variety differences within AAE. With respect to testing the utility of PoLaR for describing prosodic differences within and across varieties, the current study represents a step forward in using phonetic methods that are more independent from phonological assumptions in order to describe intonational systems. Such work will be increasingly necessary for linguists hoping to expand our knowledge of how prosody works in underdescribed languages and dialects across the world, without having to rely on intonational phonological descriptions that either may not exist,or were not intended to capture the rich variation present in naturalistic speech.

This work is also especially of interest due to the fact that not only is AAE prosody poorly understood, but also because it appears to be especially perceptually salient for listeners [2, 4], thus making it a key element for dialect identification. As a result, understanding the prosody of AAE has important utility for better addressing linguistic profiling and discrimination, developing more fair speech technologies, and understanding more broadly the realm of possible prosodic differences between American English varieties.

1.1. Prosodic Variation in MAE and AAE

Previous studies on prosodic variation in AAE have observed a number of general properties that may differentiate it from MAE. In general, studies have claimed that AAE may use a greater degree of macro-rhythm; that is, more local F0 alternations [2, 3]. This may be quantified as more (bitonal) pitch accents in the MAE-ToBI framework, as claimed by [3, 5, 6]. A number of previous works have also observed that AAE-speakers may employ a wider pitch range and/or greater use of falsetto phonation [7, 8]. While many of these previous works have been purely descriptive, they provide motivation for testing such claims quantitatively. The current study does not directly compare AAE and MAE speakers, but rather aims to provide a description of these aspects of AAE prosody as well as test for

potential effects of gender and interlocutor that may help to document such differences in ways that will lay the groundwork for future projects.

2. METHODS

One challenge for studying prosodic variation in English is that studies are still limited by existing methods, nearly all of which were designed for Mainstream American English [2]. Recent advances in both phonetics and intonational phonology, however, have prompted the development of new methods for studying prosodic variation. While it is still the case that the majority of studies in the U.S. have coded data using the MAE-ToBI conventions developed by Beckman and Ayers-Elam [9], these conventions are specifically designed for MAE, without attention to the potential for systematic variation. This is a particular limitation because ToBI systems are intentionally phonetically underspecified and intended to capture phonological categories of MAE, which may not apply for speakers of other varieties.

The Points, Levels and Ranges (PoLaR) annotation system designed by Ahn et al. [1] may be more appropriate for describing the prosody of a broader range of linguistic varieties. PoLaR uses four ties to capture phonetic detail, which is an important feature that distinguishes it from ToBi. The tiers used in PoLaR are as follows:

1. *Prosodic Structure*: Prominences and Boundaries
2. *Points:* Moments where F0 turns occur
3. *Levels*: Locally-specified F0 movements, within a given IP. Corresponds to marks on the Points Tier, and is derived from Point and Range Info
4. *Ranges*: How much does F0 change within a given IP?

Figure 1 shows an example of PoLaR coding from the current dataset.

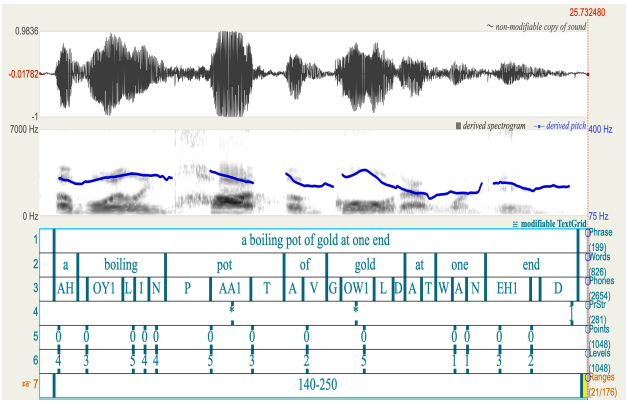

Figure 1: Tier 1 (Phrase) is the phrase's orthography. Tier 2 (Word) shows individual words. Tier 3 (Phone) shows individual phones. Tier 4 (PrStr) is the Prosodic Structure tier, roughly corresponding to pitch accents and boundaries in MAE-ToBI. Tier 5 (Points) shows points, or each instance of a phonologically meaningful F0 turn. Tier 6 (Levels) takes the points from Tier 5 and gives them a locally-determined rating of pitch level, based on the global F0 range of the phrase. Finally, Tier 7 (Range) shows the F0 range (max-min, measured in Hz) of the phrase.

2.1. Data Collection and Coding

The dataset consists of 29 recordings of self-identified AAE speakers (19 female, 10 male) reading the Rainbow Passage aloud [10]. Participants were recorded as a part of a larger study of the use of AAE on college campuses [11]. That study captured thorough demographic information about participants, but also utilized a unique design such that half of the participants were interviewed by a white, non-AAE speaking interlocutor and half were interviewed by a Black, AAE-speaking interlocutor. This design allows for the current study to test not only the effects of personal demographic categories such as gender, but also possible interlocutor effects.

Individual Intonational Phrases (IPs) were identified perceptually and annotated manually, and IPs with disfluencies or background noise were excluded, ultimately yielding 3764 IPs for analysis. IPs were then force-aligned and subsequently annotated using the PoLaR conventions developed by Ahn et al. [1] and data was extracted using a series of scripts that accompany the Praat PoLaR plugin. The relevant data is number of Points, local F0 changes within the phrase (Levels), and F0 range differences (Range) between phrases for each speaker.

2.2. Statistical Analysis

A series of logistic and linear mixed effects regression models in R using the lme4 package [12] tested differences between speaker groups related to Points, Levels, and Ranges. For comparisons related to number of points, a linear mixed effects regression (LMER) model tested for differences by gender, interlocutor, and the interaction with a random effect of speaker. Using the same fixed effects of gender and interlocutor with a random speaker effect, the model for Levels tested differences between adjacent level labels within the same IP in order to examine variation in how speakers use larger or smaller local jumps within their individual F0 range. Finally, again using fixed effects of gender and interlocutor, the model for Ranges tested differences in F0 max-min across IPs for speakers.

3. RESULTS

3.1. Points

Results for the model for number of points per second of speech by gender and interlocutor indicate that female speakers use a greater number of points than male speakers overall (Est=0.186, p<.05). The model also reveals that speakers of both genders use a greater number of points when interacting with the AAE-speaking interlocutor, though this difference is not significant. We do not observe an interaction effect between the gender and interlocutor. While Figure 2 shows the mean results for each speaker group, the lack of an interaction effect may obscure the main results.

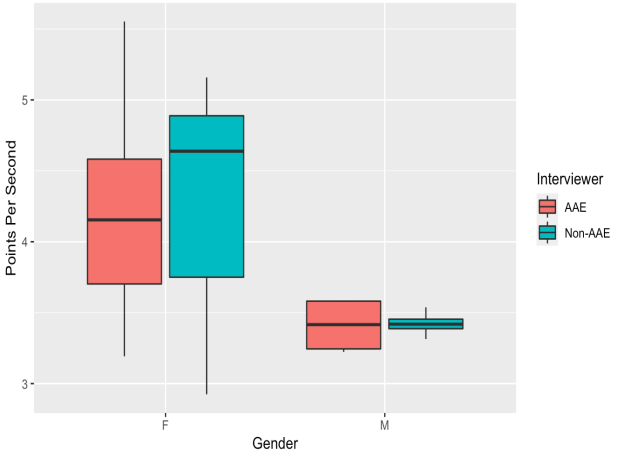

Figure 2: Boxplot for number of points by gender and interlocutor.

3.2. Ranges

Overall, female speakers use wider pitch ranges across IPs than male speakers (Est=31.878, p<.001), as do speakers interacting with the AAE-speaking interlocutor, though the effect is somewhat smaller (Est=3.423, p<.01). Again, we observe no interaction between gender and interlocutor.

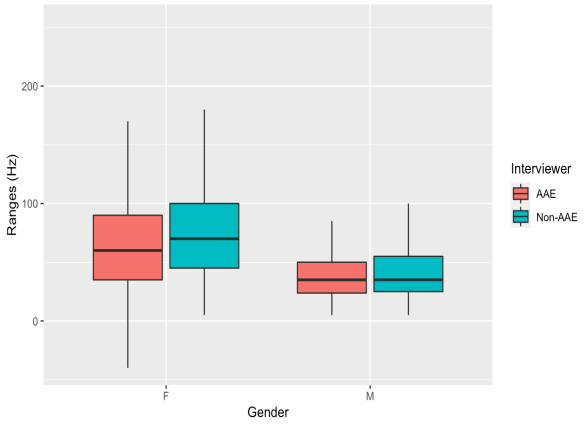

Figure 3: Boxplot for range by gender and interlocutor.

3.3. Levels

As this paper is among the first to conduct a quantitative analysis of the Levels differences coded in the PoLaR system, it will report on speakers' proportion of use of each Level, which may indicate how much time they spend in the middle versus towards the extreme ends of their F0 ranges for any given IP. In this framework, we observe that female speakers also use more dramatic local pitch differences between points, employing a greater number of 1-5 and 5-1 level jumps than male speakers (Est=0.228, p<.05). However, in contrast to the results for Points and Ranges, we do not observe interlocutor or interaction effects for this variable. Figure 4 shows the distribution of the use of each Level by speaker and interlocutor in order to show the general distribution of Levels. While this paper focuses only on the most dramatic level jumps as an illustration, future work should also examine whether there are systematic differences between speakers or varieties for other types of level jumps.

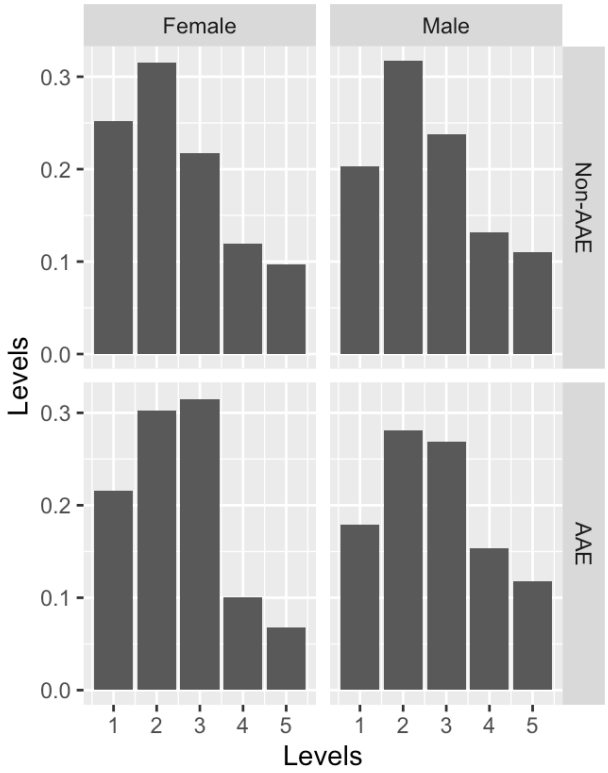

Figure 4: Proportion of use of each Level by Gender and Interviewer.

4. DISCUSSION AND CONCLUSION

In this study of the use of prosodic variation using Points, Levels, and Ranges among AAE-speaking college students, female speakers use more points and wider pitch ranges per phrase, and show more instances of dramatic level changes than male speakers. Additionally, speakers appear to be sensitive to interlocutor-based differences; speakers who interacted with an AAE-speaking interlocutor generally used more points and wider pitch ranges than those that interacted with a non-AAE speaking interlocutor. Interestingly, however, we see limited interaction effects between gender and interlocutor for any of the variables tested, indicating that perhaps effects on the use of these variables operate somewhat independently of one another. These results support the claims of previous works that assert that AAE generally has a strong macrorhythm, or more local F0 changes that manifest as simple changes, jumps between adjacent points, and differences in the use of F0 range between phrases in the same passage. The strong effects for both gender and interlocutor across phonetic variables also shed light on some social factors that may affect systematic prosodic variation in AAE. Previous work such as Li et al. [13] has documented gender differences in the use of F0 range between female and male speakers in both MAE and AAE, so the results obtained here strengthen claims that female AAE speakers generally employ a wider pitch range than their male counterparts. The findings for Levels also support this claim; greater local pitch jumps may also facilitate the use of a wider F0 range. Finally, the larger number of points used by female speakers and those interacting with an AAE-speaking interlocutor support findings such as those by McLarty [3] who observed that AAE speakers generally employed a larger number of pitch accents, though in this case, the larger number of points may be indicative of speaker accommodation to the AAE-speaking interlocutor.

Finally, these results also demonstrate the utility of the PoLaR conventions for underdescribed varieties of English. Earlier works on AAE were limited by the fact that they had to describe the variety's prosody based on assumptions that were designed for MAE speakers. This study has shown that the PoLaR annotation conventions can be successfully used in sociophonetic analysis and descriptions of prosodic variation across prosodic systems that may or may not conform to the assumptions inherent in the MAE-ToBI conventions. Future work can build on these results to arrive at a better description not only of AAE prosody, but also of other marginalized varieties of English, as well as other languages.

5. REFERENCES

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