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Proceedings of the Twenty-Ninth Annual Meeting of the Berkeley Linguistics Society: General Session and Parasession on Phonetic Sources of Phonological Patterns: Synchronic and Diachronic Explanations (2003) pp. 149-160

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The Annual Proceedings of the Berkeley Linguistics Society is published online via [eLanguage](#), the Linguistic Society of America's digital publishing platform.

A study of the speaking fundamental frequency characteristics and perceived pitch characteristics of Black and White women

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1. Introduction

Since the 1980's a modest body of literature normalizing and comparing the speaking fundamental frequency (SFF) characteristics of Black speakers has been amassed. However, this literature has not reached a consensus on whether or not the intonation of Black and White speakers differs. Several researchers have reported that Black speakers tend to use a lower SFF, although not all of these studies concluded that those differences were statistically significant (Hudson 1977, Holbrook and Hudson 1981, Holbrook and Hudson 1982, Wheat and Hudson 1988, Awan and Mueller 1996, Xue and Mueller 1996, Sapienza 1997, Hagstrom et al. 2001). Other studies report the exact opposite, finding that Black speakers have a significantly higher SFF (Tarone 1973, Walker 1981). Some studies report no differences in the SFF level of Black and White speakers (Mayo and Manning 1994, Grant and Mayo 1995, Xue and Mueller 1996, Morris 1997, Hagstrom et al. 2001). A number of studies report greater variability in Black intonation (Tarone 1973, Hudson 1977, Hudson and Holbrook 1981, Hudson and Holbrook 1982, Morris 1997). Other studies refute this claim (Mayo and Manning 1994, Awan and Mueller 1996, Hagstrom et al. 2001).

It is even more difficult to form an adequate description of the SFF characteristics of Black speakers who are female from the even sparser and more contradictory literature that specifically measures the SFF of adult Black women. The author of this study has discovered only nine such studies, four of which are for elderly populations. Hudson (1977) found that Black women have lower mean SFF levels and higher SFF ranges and standard deviations than White women. Holbrook and Hudson (1982) also found that Black women have a lower SFF than White women and that White women have a smaller SFF range and standard deviation. The reading fundamental frequencies of Black women were also found to be lower than those of White women and the reading frequency range of Black women was also found to be higher than that of White women (Hudson and Holbrook 1981). The Black women in Tarone's (1973) study, however, used a

higher pitch level, while their pitch ranges were greater than White women's. Sapienza (1997) reported no differences in the SFF of Black and White women. The majority of studies on elderly Black women report that they use lower SFF than elderly White women (Dejarnette and Holland 1993, Xue and Mueller 1996, Hagstrom et al. 2001) but there was one report of higher SFF among elderly Black women (Walker et al. 1981). Several problems may be the cause preventing the firm formation of a description of the SFF characteristics of Black women: these studies vary in instrumentation, data analysis, types of speech analyzed, and methods of comparison, factors which should alone lead to discrepancies in results.

The current body of literature on intonation leads to the conclusion that American intonation needs be reexamined as a function of race and that more data needs to be collected for Black women. The purpose of this study is to 1) collect SFF measures for samples of both Black and White women, 2) describe the SFF characteristics of Black women, 3) determine if actual differences exist in the SFF characteristics of Black and White women by comparing these measures, and 4) to determine whether any perceived differences exist in the pitch characteristics of Black and White Women.

2. Hypothesis

Intonation has been a subject of interest in the field of gender linguistics since its beginnings, as an awareness of the acoustical differences in the speech of men and women existed even in folk linguistics. Researchers of sex differences in language state three main intonational characteristics of female speakers of American English; 1) women use greater ranges of intonation, 2) women use higher SFF levels, and 3) women prefer variable intonation patterns (McConnell-Ginet 1983). While these patterns may hold true for some groups of society, there has been no compelling evidence to show that these patterns are universal, as is suggested by the language of previous works. Like researchers of American intonation, investigators of gender linguistics have largely been content to overlook racial differences and study racially skewed samples. Consequently, one must question if conclusions about the intonation of female speakers can be generalized to accurately describe the speech of all American women.

Given the influence of society on the structure and use of language, it seems very likely that even if similar patterns of intonation were found in all American female speech communities, among certain social groups there would exist consequential variability. Intonation has proven to be sensitive to several social variables, including gender (Brend 1972) and social status (Gregory et al. 2001), and so why should it lack sensitivity to such social constructs as race? My hypothesis is that as the result of their distinct social histories and realities there is a difference in the SFF characteristics of Black and White American women; it is hypothesized that Black women in upwardly mobile social positions use lower and less varied intonation than their White counterparts, and that they, like White males, imitate White female pitch characteristics in a derogatory manner.

3. Method

3.1. Subjects and procedures: Part I

This study was conducted in two parts. In Part I of the study a sample of twenty-three women were self-selected from a population of employees at the L.A. County Department of Children and Family Services. Twelve of the subjects were White women and eleven were Black women (racial classification was dependent upon answers reported in a demographic survey). The subjects ranged in age from 24 to 45 (so as to exclude those women who might be affected by adolescent or menopausal voice change), with a median age of 35 for the White women and a median age of 39 for the Black women. All of the subjects were native speakers of English and had been residents of Southern California for at least ten years.

Recordings of these subjects' speech samples took place in a quiet office. Subjects were instructed to give a job description and an account of their typical workday, speaking as naturally as possible and for at least two minutes. Several subjects had trouble speaking continuously for two minutes, preventing the researcher from collecting a full two minutes of continuous speech in six samples. The quality of two recordings may have been affected by participants speaking too low or by recordings being taken at an improper volume. Following the recordings subjects were administered demographic and mood questionnaires.

3.2. Subjects and procedures: Part II

In the second part of the study a sample of nine women were taken from a population of female undergraduate students at UCLA. All of the subjects were friends of the researcher. All of the subjects were Black and all were non-smokers. All of the subjects had been residents of Southern California for at least two years; five of the subjects having been natives of Southern California, three of the subjects were from Northern California, and only one subject was from out of state. The subjects ranged in age from 19 to 22 with a median age of 20.

Recordings of speech samples for the second part of the study took place in the subjects' homes or in the homes of their friends. Subjects were first instructed to silently read a passage. Then subjects were instructed to read the same passage out loud, pretending as if they were "Keesha", a hypothetical woman. Subjects were then instructed to read the same passage out loud once again, but this time pretending as if they were "Becky", a hypothetical white woman.

3.3. Equipment and data analysis

Recordings were made with a Marantz professional cassette recording deck (Model PMD501) and a Shure microphone (Model SM58). Eighteen second samples were taken from the midsection of the recordings from part one of the experiment. Samples from part two of the study included the entire passage and varied in length from 14 to 17.5 seconds. PC Quierer version 6.1 (PC based speech analysis software developed and distributed by Sciconrd) was used to obtain pitch analysis graphs from which measures of mean pitch were manually calculated. The mean SFF, SFF standard deviation, and SFF range for each

speech sample was calculated. Then these numbers were averaged to determine mean values for each group.

4. Results

4.1. Part I

The mean average SFF was 156.7 Hz with a standard deviation of 26.31 Hz for Black subjects. The mean average SFF was 170.3 Hz with a standard deviation of 22.03 Hz for White subjects. The mean upper limit for Black subjects was 201.9 Hz and 225 Hz for White women. The mean lower limit was 123.8 Hz for Black subjects and 135 Hz for White subjects. A 2 sample T tests at 5% showed the difference in mean SFF between Black and White subjects is not statistically significant ($t = 1.31, p = .20$).

The mean SFF for the Black subjects of this study is considerably lower than that previously reported. Hudson and Holbrook (1982) reported that the mean modal SFF for Black women is 188.85 Hz. This was the only study to measure spontaneous speech for Black women whose ages (18-29 years) overlapped with the ages of the subjects of the present study (24-45 years). The difference in the measures obtained in this study and in Hudson and Holbrook's study may be accounted for by age differences of subjects and the use of mean versus modal values. The mean SFF for White subjects is considerably lower than those values previously reported. Stoicheff (1981) reported that the mean SFF for White women 20-29 years old was 224.3 Hz, 213.3 Hz for women ages 30-39, and 220.8 for women ages 40-49. Snidecor (1951) and Linke (1953) reported that the mean SFF's of adult white females are 213.5 Hz and 199.8 Hz, respectively. These studies measured subjects reading a standard passage, while the measures in the current study involve spontaneous speech, possibly accounting for the considerable discrepancy in average values. Also, Stoicheff controlled for the smoking variable, while smoking was not controlled for in the present study.

The mean SFF standard deviation was 14.8 Hz for Black subjects and 19.49 Hz for White subjects. A 2 sample T tests at 5% showed that the difference in mean SFF standard deviation between Black and White subjects is not statistically significant ($t = 1.66, p = .11$).

Three Black subjects and four White subjects were cigarette smokers. Since one of the effects of cigarette smoking on speech has been found to be a lowering of SFF (Sorensen 1981), the seven cigarette smokers in the current study were under suspicion of having altered SFF levels. However, a comparison of the mean SFF of smokers versus nonsmokers reveals no evidence that the smokers in the present study produced different SFF levels than the nonsmokers in the present study.

Despite efforts to obtain a uniform population of university educated professional workers, one White subject and eight Black subjects were not social workers. These women were clerical workers whose education level ranged from high school to two-year College. A comparison of the mean SFF of the Black

clerical (153 Hz) and social workers (166.45 Hz) revealed no statistically significant differences between the two groups ($t = -.62, p = .58$).

4.2. Part II

The two speech samples (one as a Black woman and one as a White woman) for each of the subjects were directly compared. All nine subjects used an appreciably lower SFF level when speaking as a Black woman as opposed to when they imitated a White woman, increasing their SFF level by an average of 35 Hz when imitating a White woman. For each of the nine subjects the increase was statistically significant ($t = -2.6, p = .02$). The mean SFF for the speech productions as Black women was 231.1 Hz with a standard deviation of 25.9 Hz. This value is much higher than that reported by Hudson and Holbrook (1982) and can probably be accounted for by the theatrical nature of the speech task in this study. The mean SFF for the imitations of White women was 266.3 Hz with a standard deviation of 30.8 Hz. This value is also greater than the average values previously reported for White women but it lies within the range of mean fundamental frequencies previously reported for white women (Fitch and Holbrook 1970, Stoicheff 1981).

The mean SFF standard deviation for subjects speaking as Black women was 55.8 Hz. The mean SFF standard deviation for the imitations of White women was 60.2 Hz. This difference is not statistically significant ($t = -.56, p = .58$). In fact, seven out of the nine subjects altered the SFF standard deviation between their Black and White imitations by only a negligible degree. The other two subjects demonstrated a significant increase in SFF standard deviation when imitating a White woman.

5. Discussion of results

5.1. Comparison of Part I and Part II results

The SFF and SFF standard deviations obtained for the Black subjects in Part I of the present study are significantly lower than the SFF and SFF standard deviations obtained for subjects in Part II of the present study. This may be accounted for by three factors: age differences (Stoicheff (1981) showed that SFF decreases from early adulthood to middle age), differences in speaking tasks (SFF has been shown to vary with speech activity (Grant and Mayo 1995:32)), and differences in recording settings (intonation may vary with social situation (Tarone 1973:36)).

5.2. Part I

The results of this study indicate that Black and White women do not differ significantly in SFF levels. Instead the majority of mean SFF's for both Black and White women lie within the same overlapping range (130 to 190 Hz).

There was a tendency for the Black subjects to speak at lower SFF levels than White subjects. The Black subjects had a lower mean upper limit and a lower mean lower limit when compared to White subjects. Five of the Black subjects had a mean SFF under 150 Hz, while only two white women spoke under 150Hz.

Seven of White subjects had mean SFF over 170 Hz, while only four Black women spoke in that same range. Emphasizing this distribution pattern where the mean SFF's of the Black subjects gathered toward lower frequencies and the mean SFF's of the White subjects are gathered toward higher frequencies were outlying mean SFF's. The Black subjects account for the outliers at the low end. Conversely, the White subjects account for the outliers at the high end.

The results also reveal that Black and White women do not differ significantly in SFF variability (measured by standard deviation). Still, the Black subjects did have noticeably lower mean SFF standard deviations than did the White subjects. Only two Black subjects had a SFF standard deviation above 20 Hz, while six White subjects did. Three Black subjects had SFF standard deviations below 10 Hz, while only one White subject spoke with such little frequency variability. The SFF standard deviations of subjects followed a distribution pattern similar to the one previously mentioned, where Black subjects tended to gather toward the higher frequencies.

It is possible that statistically significant differences were not found in the mean SFF values of the Black and White women sampled in the present study because the Black subjects were not of a uniform social class. The inclusion of a large number of clerks in the sample of Black women may have attenuated any racial effects on SFF characteristics. It would appear that the results of the present study invalidate this claim, as statistical analysis revealed that there is no difference in the SFF characteristics of clerical and social workers, and Black social workers had some of the higher mean SFF's. However, the sample of Black women was relatively small, and by dividing this sample into even smaller groups for comparison, the validity of any comparisons made is compromised.

5.3. Part II

The results from Part II of the present study show that Black women do indeed perceive White women as speaking at higher pitch levels than they do themselves. When the Black subjects imitated White women, they increased their SFF levels significantly.

The results also indicate that Black women perceive White women as speaking with similar or increased pitch variability (measured by SFF standard deviation). The majority of subjects kept their SFF variability constant between Black and White imitations, although some subjects increased SFF variability greatly when imitating White women. When the speech samples were grouped by race, the mean SFF standard deviation was slightly higher for the imitations of White women than for the imitations of Black women.

5.3. Part I and II in tandem

The imitative behaviors of the subjects indicate that there is a perception of pitch characteristics that may not wholly reflect actual speaking behavior. Black subjects significantly increase their SFF level and in some cases their SFF

variability when imitating White women, despite the fact that most Black and White women display similar SFF characteristics. The sharp contrast that Black women expressed between the imagined SFF characteristics of White women and their own parallels the dispersion patterns of extreme mean SFF's. Black women comprised the outliers and the majority of speakers at lower SFF levels and SFF standard deviations while White women comprised the outliers and the majority of speakers at higher SFF levels and SFF standard deviations.

I propose that these subjects are conveying greater differences in the pitch characteristics of Black and White women than actually exist because they perceive a conspicuous difference in the pitch characteristics of Black and White women. I further suggest that this altered perception is due to a focus on the extreme speakers and that it is the marginal and not the majority that exerts influence over perception when Black women hear the speech of White women.

6. Analysis and implications

6.1. Racial effects on intonation

Consistent with the findings for the elderly (Xue and Mueller 1996, Hagstrom et al. 2001), children (Awan and Mueller 1996, Wheat and Hudson 1988), and young adults (Hudson 1977, Holbrook and Hudson 1982), the Black women in this study tended to speak with lower fundamental frequencies than White women. Consistent with the findings of Xue and Mueller (1996) and Hagstrom et al. (2001), Black women have lower SFF standard deviations than White women. The results of this study do not show a statistically significant difference the SFF characteristics of Black and White, but the dispersion patterns of SFF values point to the conclusion that race does matter in intonation. Several previous studies have failed to find a difference in the SFF characteristics of Black and White speakers (Mayo 1990, Mayo and Manning 1994, Grant and Mayo 1995), but these studies were not designed in a way to investigate language in its social context. For the socially triggered effects that I hypothesized to be displayed in speech, speakers would have to be involved in social interaction such as the interview or role-play tasks used in the present study. Studies that obtain measures from reading or sustained vowel production are not suitable for detection of what are, I suggest, socially-conditioned racial effects on SFF.

6.2. The speech of the powerless

The results of this study indicate that there is a slight tendency for professional Black women to speak with lower and less varied SFF than their White counterparts. These racial differences can easily be explained using the same theories of the relation between power, language, and society used to explain sexual differences intonation. For the intonational patterns established for White women imply instability, a lack of self-control, and inferiority (Cameron 1982:74, McConnell-Ginet 1982), and Black women are a historically oppressed and socially disadvantaged group who are fighting to avoid such negative stereotyping. A rejection by professional Black women of this "powerless"

language is an attempt of a “powerless” group in society to assert power, command respect, and effect upward social mobility. Common sentiments in this community are that “if you are a Black woman on the job, you’re probably fighting marginalization, invisibility and often out-and-out racism from nine to five” and that in the competitive business world White women have “the power... of blonde hair and blue eyes” (Golden 2002:190,194). These beliefs that the same resources available to White women are not available to themselves have given professional Black women the incentive to seek out language as an alternative means of power acquisition.

Not only has it been shown that voice fundamental frequency has a function in communicating information about social status (Gregory et al., 2001), but lowering SFF level and variability does appear to provide certain social rewards to women, namely greater credibility and access to authority and professional mobility (Kramer 1974, Thorne and Henley 1975:19). In fact, several magazines, assertiveness training courses, and self-help books advise professional women to lower their pitch in order that they might be taken more seriously (Cameron 1992). The results of this study combined with previous knowledge about women’s intonation imply that Black women have taken heed of the negative stereotyping of female speech and are capitalizing upon the power strategy of avoiding White women’s intonation in order to advance in the professional world.

One may ask why then are White women content to continue using the intonation labeled instable, inferior, and lacking in self-control? They are probably not; previous studies show that lowering intonation is a power strategy that may also be employed by White women. This may well be implied by the fact that the SFF values for professional White women in this study were considerably lower than the values for nonprofessional White women in previous studies. The results of this study, however, indicate that Black women emphasize their use of certain SFF characteristics even more than White women. I suggest that this is because Black women feel that they must work twice as hard to achieve the same. Further experiments controlled for professional status are necessary for both races to verify this point.

The results of the second part of this study revealed that Black women speak with higher SFF levels and sometimes-greater SFF variability when imitating White women. The fact that Black women change their SFF characteristics when imitating White women demonstrates that Black women perceive a difference in the pitch characteristics of Black and White women and have stereotyped the speech of Black and White women. As mentioned earlier, high and variable pitch has several negative associations. This is especially true in the Black English speech community, where high pitch is associated with dishonest discourse and low pitch is associated with true discourse (Morgan 1996:415). I suggest that Black women emphasize the above mentioned pitch characteristics in the speech of their White counterparts while deemphasizing them in their own speech because they connect negative associations with White women and positive associations with themselves. When White men imitate White women by

producing high and varied pitch it is done in a derogatory fashion (McConnell-Ginet 1982:74). The results of the present study indicate when Black women emulate the pitch characteristics of White women it also has negative implications. Several of the subjects adopted a mocking attitude when imitating a White woman, indicating that to speak like a White woman is viewed as derogative and that their high and varied intonation patterns are viewed negatively.

6.3. Stereotypes

The discrepancy between differences in SFF characteristics of Black and White women and the differences in pitch characteristics perceived by Black women begs us to ponder the question: How are stereotypes created? As the results of this study illuminates, the explanation of the birth of stereotypes is tied to the very nature of perception.

While no statistically significant differences were found in the SFF of Black and White women, there were differences in the dispersion patterns of their SFF. There was a tendency for Black women to speak at lower SFF levels and to lay as outliers on the low end and for White women to speak at higher SFF levels and to lay as outliers on the high end. There was also a tendency for Black women to have lower SFF standard deviations and to lay as outliers on the low end and for White women to have higher SFF standard deviations and to lay as outliers on the high end. Perhaps it is the distribution of extreme speakers that act as a catalyst in the formation of the stereotype that White women speak at higher pitches and with greater pitch variability. As Black women take notice of the pitch of only the speakers who display extreme pitch characteristics and as the qualities associated with these characteristics coincide with Black women's beliefs, perception pushes Black women to perceive White women as speaking with high and variable intonation and Black women as speaking with low and level intonation despite the fact that most Black and White women speak with similar SFF characteristics.

Adler et al. (1983) have proposed an analysis of the process of perception. In our everyday tasks of organizing the world, we are bombarded with far more stimuli than we have the capacity to process. Since we cannot focus on every single sensation in the world, the first steps of perception involves a process of selecting which stimuli to pay attention to and which to ignore. In order to manage the plethora of stimuli, the human brain focuses on stimuli that stand out, in this case, speakers with extreme intonation patterns. Another factor influencing our selection of which stimuli to focus on is our motives (Adler et al. 1983: 56). It can be speculated that Black women are motivated to perceive White woman as having high and variable (or "powerless") pitch because of their desires to attain power amid racial competition. Black women perceive White women (even those White women who speak with a normal SFF level and normal SFF variability) as speaking extremely because they do not notice the majority of speakers who display normal pitch characteristics, instead, driven by motives, they focus on

those who stand out and generalize about the whole population based on a few, thus leading to the creation of a stereotype.

7. Conclusion

The results of this study have led to two major conclusions:

1) While there are no statistically significant differences in the SFF characteristics of Black and White women, Black women had lower mean SFF levels, and lower mean SFF standard deviations. In addition, the summary statistics for each racial group tended to be dispersed around opposite ends of the continuum. These results have greater validity than those of previous studies because the current study uses spontaneous speech samples as opposed to reading samples or prolonged vowel production and because the comparisons of the current study were made using data collected at the same time and in the same manner for both racial groups. 2) There are perceived differences in the pitch characteristics of Black and White women. Black women perceive White women as speaking at a much higher pitch level and in some cases with much greater pitch variability than they do themselves.

Three explanations are suggested for:

1) Black women have devalued the pitch characteristics traditionally associated with “women’s speech”. 2) Professional Black women avoid these speech patterns as a means of self-assertion and power acquisition. 3) The stereotypes that Black women have formed about White women’s pitch characteristics are due to the very nature of perception, whereby attention is focused on the conspicuous and influenced by motives.

Studies of speaker race identification (Lavner et al. 2001) and cases of housing discrimination (Lundy and Massey 2001) demonstrate that suprasegmental differences between the races are perceptible and have significant societal implications. This study further supports the notion that pitch characteristics are perceptually salient and are instrumental in social interaction. It is imperative that language continues to be studied as a function of race, both for the sake of a more comprehensive understanding of its usage and because it leads us to insight about more general issues pertaining to race and society.

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