PHONETICS, GENDER, AND SEXUAL ORIENTATION*

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1. Introduction

In our research over the past few years, we have been examining what it is about some men's voices that causes listeners to judge them as sounding gay (Rogers, Smyth, and Jacobs, to appear (a, b); Smyth, Jacobs, and Rogers, 2003; Rogers, Jacobs, and Smyth, 2001). The phonetic variables that correlate with these judgements include:

a. the duration of the sibilants /s/ and /z/;
b. the peak frequencies of /s/ and /z/;
c. the aspiration duration of syllable-initial voiceless stops;
d. the degree of velarisation of the lateral /l/ (as measured by the second formant frequency);
e. the durations of some vowels; and
f. the peripherality of some vowels, which relates to clarity of articulation.

On the other hand, we have found no relationship between gayness judgements and:

g. mean pitch or
h. overall mean formant frequencies of vowels.

In this paper we will try to situate these phonetic findings within the context of notions of gender as a sociolinguistic category. We will argue that a full understanding of the sociophonetics of gay men's speech requires much more thought about

a. the range and complexity of gender categories,
b. the emergence of gender differentiation in the speech of children, and
c. differences between more and less conscious gender performance.

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*The authors note with great regret the sudden death of Greg Jacobs in the fall of 2002; he had collaborated with them in much of this project over the past years.

2. Conceptualizing the sociophonetics of gender

In English we have a fairly extensive set of words to refer to gender roles, such as *male, female, man, woman, boy, girl, gay, lesbian, transgendered* (M to F; F to M*), queen, fag, dyke, cross-dresser, drag queen, drag king, butch, femme, hermaphrodite, asexual, bisexual, queer,* and so on.

There is a great deal of variation in the extent to which these words denote social categories; for example, there is clearly a gay and lesbian community in Toronto, but probably no asexual community. Social groups can develop their own linguistic features, most often involving special lexical items or patterns of interaction in discourse. But because our research is sociophonetic, we would like to raise the question of whether each of these identifiable gender groups has a different set of phonetic markers of their group identity.

One problem, though, is that while a handful of researchers have started to examine the sociophonetics of gay men's voices, the other groups have rarely been mentioned. The two recent survey books by Blackwell on sociolinguistics (Coulmas 1997; Chambers et al. 2002) treat phonetic variation in considerable depth. And although both volumes have chapters dealing with language and gender, neither looks at the effects of gay-straight differences, let alone other gender categories, on speech. Labov, in his recent book Principles of Linguistic Change: Social Factors (2001), reports in a footnote that studies of gender differences in language have generally failed to distinguish even between gay and straight speakers.

Leap (1995, 1996) and Livia and Hall (1997) have examined certain aspects of gay and lesbian language, but here, there is very little on phonetic aspects, although there is somewhat greater inclusion of other gender categories.

What does exist generally sufferers from sampling problems (e.g. Gaudio 1994, with hand-picked subjects, four gay and four straight; Crist 1997 with one straight and two gay speakers). These studies also address only a few research questions (mainly whether gay men's voices have higher pitch, or whether the sibilant /s/ is different from that of straight men). Our research has been more extensive, looking not only at a range of speech sounds, but also at different groups of listeners, different spoken discourse styles, and at whether the gay-sounding phonetic cues tend to co-occur in the same speakers.

Although these studies do point to certain phonetic differences between gay-sounding males and others, the interpretation, including our own, has been somewhat limited. The finding of special phonetic characteristics of gay-sounding voices may be descriptively interesting, but it does not address the deeper question of how such features are acquired and maintained.

For example, we have frequently asked ourselves how and why a boy or man would speak in a way that may be socially stigmatized in both straight and gay

circles (although we acknowledge that a gay voice could have social prestige in limited contexts). This leads us to conclude that gay-sounding features must be acquired unconsciously, i.e. the speakers are not aware of them and they are not able to alter them easily. This in turn suggests that they are acquired at an early age.

In particular, we know that some young boys have cross-gender speech features well before they have frequent exposure to a community of gay men. In cases of gender dysphoria a young boy adopts a female identity, including feminine-sounding speech, female clothes and makeup, referring to himself as a girl, and adopting female roles during play (e.g. Rekers 2002). Less dramatically, parents and teachers used to regularly send little boys with what they termed "gender-inappropriate" speech for speech therapy.

Male/female differences in children's speech appear quite early. We will discuss specific phonetic examples a bit later, but it is worth noting that the early emergence of gendered speech and language indicates that gender identity is also established quite early. This early emergence thus parallels other identity-linked phonetic variation, such as regional dialects, ethnic variants, and class markers.

3. Personality, social affiliation, and gendered speech

It seems safe to say that a child's developing gender identity, like his or her ethnic or class identity, is expressed in speech because of interaction and social identification with people in the same social group. This entails some combination of relatively high frequency of input from those speakers, and selective attention to that input, both leading to the adoption of the phonetic variant.

The problem is that few sissy-sounding boys spend large amounts of time with gay or gay-sounding men. So boys who acquire these features must typically be getting them from their female family, friends, teachers, and other role models.

Surprisingly, though, the sparse literature on gay-sounding speech has not addressed the question of whether the features we are identifying are in fact the same as male/female differences.

If feminine phonetic features are acquired by some boys at an early age, how can we account for the fact that even within the same family, one boy may sound gay or feminine while another does not? In the second language acquisition literature, a distinction is drawn between *input* and *intake* (Ellis 1994). Input to the learner will not affect learning if the *affective filter* prevents it from doing so. Affective factors such as personality variables, interest and motivation can affect the both the amount of interaction and the influence of the input on the learner.

A similar model could be applied to the acquisition of sociophonetic gender differences. Boys who acquire feminine speech features should be those who are not only regularly exposed to female speech, but also those who have a special

social affiliation with girls and women. For these boys, the affective filter prevents stereotypically male-sounding features from acting as intake to the phonetic system. Straight-sounding boys are selectively ignoring the same input. It is also interesting to speculate about which specific role models contribute which phonetic features, or whether the acquisition of these features is based on the child's overall impression of how male and female speech differ.

This leads to the testable hypothesis that gayer-sounding men should be the ones who fall toward the feminine end of a masculine-feminine personality continuum, as measured by various psychological tests, such as the Bem Sex Role Inventory, the California Psychological Inventory, the Guildford-Zimmerman temperament survey, the Marke-Gottfries Attitude-Interest Questionnaire, the Attitude-Interest Analysis Test, the MF scale of the MMPI, and projective tests such as the Frank Drawing Completion Test, the Rorschach, the Draw a Person test, etc.

Given all of the above, we would like to pose the following question: Is it necessary, from a purely sociophonetic standpoint, to pay attention to multiple gender categories? Our provisional hypothesis is that there exists a single gender continuum from masculine to feminine, and all gender-linked sociophonetic variation can be situated on that continuum.

Thus, we reject the notion that there are simply two gender-linked categories, 'masculine' and 'feminine' speech. Although the traditional gender dichotomy can reveal average differences, it is too coarse to answer detailed questions about the relationship between gender identity and speech. For example, we expect that even within the population of heterosexual females some speakers will have more 'masculine' phonetic features than others. Crucially, this will make it possible to examine interactions between gender and other sociolinguistic categories. For example, do female heterosexual speakers in certain social or occupational classes have more 'male' features than others, or is gendered speech entirely a matter of personality?

4. Literature: male-female differences

To test the notion of a single continuum, we need to examine male-female differences for speakers in general. Some phonetic differences are the result of anatomical or physiological differences between men and women, but where there is no biological difference, we are forced to conclude that the source of the difference is social in nature.

It is also useful to examine what is known about the development of these features in children's speech. Boys and girls exhibit no differences in their vocal tracts before puberty; however, at puberty, the male vocal tract changes rapidly. It

expands considerably, and the vocal folds lengthen and thicken somewhat. Prepubescent boys and girls are thus somewhat comparable to gay and straight adult men, in that both pairs exhibit certain gender-linked phonetic differences, but no relevant anatomical or physiological differences.

The next section examines a number of features for males and females, both adults and children. After presenting the literature for each point, we will give the results from our gay-straight sounding research for comparison. Our overall conclusion is that the gay-sounding speakers show similar characteristics to female speakers.

4.1. Pitch (F0)

By far the most salient and most discussed male-female difference for adults is F0 — pitch. Many studies (Linke 1973; Linville & Fisher 1985, Murry & Singh 1980, Hillenbrand et al. 1995) have shown F0 to be a very robust cue for distinguishing male and female adult voices, with male voices having a pitch about 100–150 Hz lower than female voices. The adult phonetic difference is attributable to the longer vocal folds of post-pubertal males.

Despite the importance of F0 as a cue, several studies have shown that listeners accurately identify the gender of speakers when speech has been artificially adjusted to equalize F0 for men and women speakers; this clearly means that gender-linked cues other than F0 are present in adult speech.

Listeners are also able to identify the gender of children's voices from both sentences and isolated vowels (over 80% accuracy in Sachs, Lieberman and Erickson 1973). Fitch and Giedd (1999), using MRI measurements, report no differences in vocal tract length in younger children. As children of both sexes grow larger, the vocal folds also lengthen, and F0 gradually descends. Perry et al. 2001 also found no difference for children at 4 and 8 years of age, but by 12 years, gender-linked differences in F0 were clearly apparent.

In our research, there was no significant relationship between F0 and gayness ratings. Thus, for F0, gay-sounding speakers are not like female speakers. For listeners, mean fundamental frequency alone is not a cue to sexual orientation.

4.2. Formant frequencies

The vowel formants of adult female speakers are higher than those of adult male speakers (Childers & Wu, 1991, Coleman 1976, Peterson & Barney 1952; Wu & Childers 1991, Hillenbrand et al. 1995). Vowel formants are dependent on the length of the vocal tract. As we noted above, adult males have, on average,

longer vocal tracts than women, and thus, as expected, have slightly lower vowel formants than adult females.

As we have already mentioned, younger boys and girls show no significant difference in the length of their vocal tracts. Perry et al. found lower vowel formant frequencies for boys than for girls, for 4 and 8 year olds, even after partialling out differences in body size (which are strongly correlated with vocal tract length).

Lee et al. (1999) examined 436 children between the ages of 5 and 17, and gave us access to their raw data. In our analysis of the formants of their 5 and 6 year olds, who are clearly prepubertal, we have found significantly higher values for F1 and F2 for girls, with the exception that F1 with front vowels showed no difference for gender. Further the F2-F1 difference was greater for girls for all vowels. Since there are no documented differences in vocal tract dimensions for boys vs. girls of this age, we conclude that the formant differences are socially determined: either girls are adopting higher formants like mature women, or boys are adopting lower formants, or both.

Hillenbrand et al. 1995 have also given us access to their raw data, and our analysis found, like others, that women show greater variation in the formant frequency values than do men. From their measurements of 10-year-olds we found that there is more variation with the girls than with the boys, and that the children exhibit more variation than the adults.

However, in our own data, there was no general tendency for gay-sounding speakers to have higher formants than straight-sounding speakers, or for there to be greater formant variability in the gay-sounding voices. Thus, for formant frequencies, gay-sounding speakers are not like female speakers (but see 3 below). This is a bit surprising, given that children do seem to be able to alter formants by lengthening or shortening the vocal tract, and adult male-to-female transsexuals do seem to be able to make similar adjustments (Pausewang-Gelfer 1999, and Pausewang-Gelfer & Schofield, 2000.

4.3. Vowel peripherality

The phonetic literature (e.g. Diehl et al. 1996) reports that women's vowels occupy a larger space and tend to be more peripheral than men's. While peripherality can be viewed as increasing contrastiveness, it is also the case that the higher F0 in women leads to decreased harmonic sampling compared to lower male voices, so the greater peripherality might simply be a compensation for this, rather than an enhancement.

On the other hand, as Milroy & Milroy 1997 point out, "Females tend toward the careful end of the continuum and males toward the casual end". So despite the ambiguity of the results for women vs. men we have examined gay- vs. straight-

sounding voices with the expectation that the former would have more peripheral formants leading to clearer vowel articulation. In the all-male sample, the comparisons are not confounded with F0 differences, since we found none in our pitch analyses.

As we reported in [insert reference to CLA proceedings] we found with gay-sounding men significantly greater peripherality for the front vowels: /ɪ/, /e(j)/ and the back vowel /ʌ/. We found marginally significant peripherality for some of the other vowels, and even in the nonsignificant results there were no cases where the gay-sounding vowels were more centralised than the straight-sounding vowels.

Thus, vowel peripherality provides some evidence for the confirmation of our hypothesis.

4.4. Vowel length

Simpson (1998) found longer vowel durations for women in German and in American English. Ericsdotter and Ericsson (2001) found that in Swedish, men had shorter stressed vowels than women, but there was no difference for unstressed vowels. Our analysis of the Hillenbrand data showed similar results: i.e., longer vowels for women.

In our data we found that longer vowel durations were associated with higher gayness judgements, but only for the vowels /I/ and /ej/. Thus for vowel duration, gay-sounding speakers are somewhat like female speakers.

4.5. VOT

Swartz 1992 and Whiteside & Irving (1997) both found longer VOT for women than for men. Whiteside and Marshall (2001) found that gender differences emerge in late preadolescence. This appears to be a socially based difference for all ages.

In our data, VOT for the gay-sounding speakers was significantly longer than for the straight-sounding speakers. Thus, for VOT, our hypothesis is confirmed that gay-sounding speakers are like female speakers.

4.6. /s/ and /z/

Ingemann (1968) and Schwartz (1968) independently found that in adult speech gender could be determined accurately from listening only to an isolated voiceless /s/ fricative.

Schwartz 1968 says that /s/ and /ʃ/ have higher peak frequency for women, and suggests that this likely responsible for the ability to identify gender. Fox et al.

(2001) measured fricatives for both genders and various ages. They report that the spectral mean for /s/ is higher for women ($p < .001$), and significantly higher than for /ʃ/ in females, while it was lower for males. We assume that these differences are social in nature.

In our studies,/s/ and /z/ had significantly greater duration and higher peak frequency for gay-sounding speakers than for the straight-sounding speakers. For duration of the sibilants, we have no direct comparison to male/female differences, but for peak frequency, our results agree with those for male vs. female speakers. The other studies only report on /s/, not /z/, but we assume that the duration and spectrum of /z/ would have been similar if it had been measured; moreover, we found high correlations between the gayness ratings for both duration and peak frequency of these two sibilants.

4.7. Lighter vs. darker /l/

Both Dalston (1975) and Stevens and Blumstein (1994) report a higher F2 for /l/ in women. The acoustic effect of this is a clearer type of /l/.

In our data, /l/ had a significantly higher F2 for the gay-sounding speakers than for the straight-sounding speakers. Thus, for /l/, our hypothesis is confirmed that gay-sounding speakers are like female speakers.

Discussion

5.1. Biological

For two of the features which distinguish male and female speech, there are no corresponding gay-straight sounding differences: F0 and average formant frequencies. With respect to these features, gay-sounding men simply sound like men.

There is a widespread expectation among lay people that gay sounding voices will have higher pitch. We believe that this expectation derives from a campy type of speech, where indeed a higher-pitched voice is used. Pitch variation in story telling is a standard technique, for example to characterise voices such as a low-pitched voice for *the Big, Bad Wolf* and a high-pitched voice for *Goldilocks*. We note that voice therapists for male-to-female transsexuals (Pausewang-Gelfer 1999, and Pausewang-Gelfer & Schofield, 2000) recommend using a much higher-pitched voice (at least 160 Hz); however, they recognise that this is difficult for men to maintain, reporting dozens of hours of therapy as sometimes being required. If raising F0 for extended periods of speech is that difficult, it is not hard to understand why men, gay or straight, would not regularly use it.

Higher formants are characteristic of female, but not gay-sounding, speech. Clearly men can raise their formants by manipulating articulatory position, by advancing the tongue root, or by raising the larynx. However, it appears that our gay-sounding men did not do any of these things. Again, therapists for male-to-female transsexuals advised techniques such as 'smiling', raising the larynx, and raising the mandible in order to reduce vocal tract length and increase formants.

We note that F0 and higher formant frequencies are linked to the physiological differences between men and women, and we attribute them to biological, not social, sources. This raises the interesting question of whether gay-sounding men may be using female features which have a social motivation, but not those features which have a biological motivation.

Note, however, that formant frequencies are higher for preadolescent girls. We attribute this difference to social factors, but we do not know whether the girls raise their formants or whether boys lower theirs, or both. It is interesting that after puberty, anatomy causes the same effect of higher formants for females which was achieved socially prior to puberty. It is also interesting to note that gay-sounding males make no general effort to achieve higher formant frequencies.

Simpson (2001) argues that the smaller vocal tract for women would contribute to the peripherality of adult female vowels. She shows that a female speaker operating with the same articulatory speed and within the same time period as a male speaker could maintain greater differentiation in her acoustic vowel space by travelling a greater articulatory and acoustic distance in the same time frame. We agree with her analysis that a smaller vocal tract would produce a higher formant frequency with all other things equal, but more peripheral is not the same as higher. For the vowel /i/, for example, more peripheral would mean a higher F2, but a lower F1. In short, Simpson's phonetic analysis is correct, but it supports a different point than the one she was making.

5.2. Social

At this point, we would like to consider the relevance of the notion of 'more carefully articulated speech'. As mentioned earlier, Milroy and Milroy (1997, 55) say 'Variation according to gender appears to be universal and, in terms of style, the tendency appears (in Western societies at least) to be always in the same direction. Females tend toward the careful end of the continuum and males toward the casual end. Similarly, it can be said that females favour "prestige" norms and males vernacular norms.'

If women use 'more carefully articulated speech' than men, then it is reasonable to ask whether gay-sounding speech is also 'more carefully articulated' than straight-sounding speech. Greater articulatory clarity arises when one

pronunciation has greater perceptibility than another. In general, a longer articulation of anything enhances its perceptibility, such as longer vowels, longer VOT, or longer sibilants. A longer VOT would also serve to make the voiced/voiceless contrast more readily perceived. For the sibilants /s/ and /z/, a higher spectral peak or higher spectral mean would help to distinguish /s/ from the other fricatives, especially. /ʃ/ and /θ/.

Diehl et al. (1996) have argued that the higher F0 of female voices means that the spectral envelope of female vowels tends to be more sparsely sampled harmonically and thus more difficult to perceive. They argue that a more peripheral vowel system would act to compensate for this difficulty. Thus, more peripheral vowels could contribute to a general perception of more careful articulation. If the peripherality were only of such a degree as to compensate for the more widely spaced harmonics, it should not be perceived as contributing to more carefully articulated speech. However, if female speakers exaggerate this peripherality and go beyond the minimum, they could be providing a model which relates to the tendency towards greater peripherality that we have seen in gay-sounding male voices.

Despite our present focus on early acquisition, we do acknowledge the possibility that a gay-sounding voice might be acquired later in life, perhaps after a man joins a gay social network. Here, parallels to second dialect acquisition (see Chambers 1995) might be appropriate. Moving to a new dialect area can affect the speech of adults to varying degrees, presumably depending on affective variables. Second dialect acquisition in adulthood is also somewhat unstable: the person's new variants often co-exist with the original ones, and they may disappear when the individual returns home, although the speaker is often able to revert to the new dialect at will. Second dialect pronunciations thus appear to be to some extent under conscious control. But to our knowledge there has been no consistent effort to tease apart these two aspects of the acquisition of gay speech styles. In particular we know of no longitudinal research that has examined changes in young men's speech during the first years of coming out into a gay community.

In our work we have tried to draw a distinction between more and less conscious use of the gay voice. For example, gay men sometimes switch from their normal speaking style to a more feminine voice for dramatic and usually humorous effect, and this is not unheard of even among straight males. The adoption of this 'camp' style may even have its origins in childhood play with gender roles. The crucial point is that it involves the self-conscious performance of a different persona. Camp performance is certainly a legitimate area of sociophonetic study, but we have tried to focus on less conscious gender performance, where the speaker is using his own identity and his more usual speech style. We assume that under these circumstances, such as reading a scientific passage, our speakers are

not camping it up, and that the gay-sounding features we have measured are part of the person's normal phonological system. In support of this we have found very little variation in how 'gay' the voices were rated in three styles: reading a science article, reading dramatic fiction, and describing an exciting event — except that straight-sounding men were judged to sound a little less straight when they read the scientific materials.

5.3. Categories vs. Continuum vs. Menu

As we have already said, our provisional hypothesis about phonetic gender variation is that there exists a single gender continuum from masculine to feminine, and all gender-linked sociophonetic variation can be situated on that continuum.

In previous reports (Smyth, Jacobs, and Rogers, 2003; Rogers, Smyth, and Jacobs, to appear; Rogers, Jacobs, and Smyth, 2000, 2001) we have shown that there is considerable variation in which phonetic features make a voice sound gay. For example, in multiple regression analyses, we have shown that sibilant frequency, sibilant duration, and /l/ fronting make independent contributions to the prediction of gayness ratings. This means that different speakers use these phonetic variables to different degrees.

We suggest that the same can be said of any speaker: for each phonetic variable the speaker will fall somewhere along the masculine–feminine continuum. This leaves open the possibility that an individual can have contradictory gender features, such as fronted /l/ but low peak frequency of /s/.

One issue we have not yet dealt with is the relative contribution of each variant toward gayness ratings. For example, does having high peak frequency for sibilants mark someone as gay-sounding to a greater extent than long durations of sibilants? We have therefore proposed speech synthesis experiments which would examine the effects of variation along a single phonetic continuum, such as peak frequency, on gayness judgements.

Although we are proposing a simple model which states that all sociophonetic gender variation falls along a single continuum from masculine to feminine, we expect that it will not always work in a straightforward manner. For example, in previous work we had the same voices rated as gay vs. straight, and also as masculine vs. feminine. In support of our simple model, there was a high correlation between the ratings on these two measures. On the other hand, gay-sounding voices were not rated as feminine if they had low pitch, which suggests that listeners are influenced by the biology of gender in applying the labels 'masculine' and 'feminine'.

Another complexity arises from the possibility that there is an asymmetry between sexual orientation judgements of male vs. female voices. In particular, we

suspect that masculine features in female voices may have less of an effect on judgements of sexual orientation than feminine features in male voices.

In summary, then, our position is that research on the sociophonetics of gender will be enriched by greater attention to the whole gamut of gender categories. Rather than dichotomizing gender, we think that there is much to be gained, both empirically and theoretically, by studying phonetic variation in all manifestations of gender. In our approach, the null hypothesis is that all gender variation is male/female variation, and our evidence so far, involving gay men, generally supports this view. It remains to be seen whether the hypothesis can be supported for all gender categories.

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