

# Hegemonic masculinity and the variability of gay-sounding speech

## The perceived sexuality of transgender men\*

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Sociophonetic inquiry into sexuality and the voice has often focused on the perception of men's sexuality on the basis of disembodied voices. However, inconsistencies across these studies limit our ability to unite their findings into a cohesive model of gay-sounding speech. This paper focuses on variability among gay-sounding speakers by analyzing the voices of female-to-male transgender individuals, or trans men. Trans men who make use of testosterone typically experience a significant drop in vocal pitch, yet may maintain stylistic traits acquired while living in a female social role. An acoustic and perceptual analysis of trans and non-trans men's voices reveals that even as trans men may be perceived as gay-sounding, their sociolinguistic styles also differ from those of gay-sounding non-trans men. These findings support the notion that gay-sounding speech does not constitute a single phonetic style, but rather numerous deviations from the hegemonic norm.

**Keywords:** transgender, voice, perception, sociophonetics, gender, masculinity, heteronormativity, style

### 1. Introduction

In the establishment of language and sexuality as a field of sociocultural linguistics, the perception of certain voices — particularly men's voices — as indexing gay identity has become a central topic of inquiry (Campbell-Kibler 2007, 2011, Gaudio 1994, Linville 1998, Munson 2007, Munson, McDonald, DeBoe & White 2006, Pierrehumbert, Bent, Munson, Bradlow & Bailey 2004, Smyth, Jacobs & Rogers 2003, Zwicky 1997). Among the most widely pursued goals in this body of work is the identification of acoustic variables that correlate with perceived sexual orientation among male speakers of American English. However, it is difficult to

synthesize the findings of these studies into a cohesive model of what constitutes a “gay-sounding” male voice. I argue that the contradictions that appear across studies of gay-sounding voices are best understood as evidence that there is no single gay-sounding style, but rather a multiplicity of styles that can be interpreted as indexing sexuality by virtue of their departure from normative masculinity. This proposal, which also appears in publications by Zwicky (1997), Barrett (1997), and Podesva, Roberts and Campbell-Kibler (2001), reflects the workings of hegemonic masculinity as a dominating social force that privileges a narrow range of acceptable forms of gender expression for men while relegating a large range of non-normative masculinities to the stigmatized category of “gay” (see Cameron 1997, Connell 1995, Kiesling 2002, Pascoe 2007). In order to explore the question of whether different combinations of phonetic traits might make two speakers sound equally gay, I present perceptual and acoustic analysis of two groups of gay-sounding male speakers who are perceived similarly despite their stylistic differences.

Specifically, I bring to this discussion my work with female-to-male transgender individuals, or trans men, who remain largely absent from the literature on language, gender and sexuality. As individuals whose male identities may be socially precarious and whose lived experience diverges from that of *cisgender* (i.e. non-trans)<sup>1</sup> men, these speakers promise to tell us much about the linguistic negotiation of hegemonic masculinity. Trans men are individuals who were assigned to a female gender role at birth but at some point come to see themselves as men; often, these self-identified men engage with various medical interventions in order to masculinize their bodies. The most common — and most linguistically significant — of these interventions is testosterone therapy, which causes a marked drop in vocal pitch along with other bodily changes (Papp 2011, van Borsel, de Cuyper, Rubens & Destaecke 2000, Zimman 2012). The handful of studies on the voices of trans men, including my own ethnographic fieldwork in the Bay Area from 2010 to 2012, point to the importance of vocal changes brought about by testosterone in enabling trans men to be recognized as male in their everyday lives. At the same time, Zimman (2012) documents a great deal of variation in the gendered phonetic styles employed by 15 English-speaking trans people who were in the process of transitioning from female to male with the help of masculinizing hormone therapy. Although these trans speakers all experienced a significant lowering of their vocal pitch, many had speaking styles that diverged from culturally dominant expectations for heteronormative men’s voices. Furthermore, it is not uncommon for trans men to speak about being perceived as gay men once they are moving through the world as members of their self-identified gender. Because trans men are often not visibly trans, but rather assumed to be cis men (see Edelman 2009),<sup>2</sup> deviations from normative masculinity on the part of trans men may be interpreted as evidence of a gay identity rather than a trans history.

For some, especially trans men who are attracted to other men, this perception is welcomed as an accurate characterization of their sexuality. But trans men who are primarily or exclusively attracted to women may experience it as a source of misrecognition. Driven by the accounts of trans men in urban American trans communities, I designed an experiment of perceived sexuality following models like Smyth, Rogers and Jacobs (2003) and Munson (2007) that included both trans and cis male speakers. The questions behind this work are concerned with whether trans speakers might be perceived in the same way as gay-sounding cis men, why this might be the case, and whether their phonetic styles would be as similar (or dissimilar) as their perceived sexuality.

I begin this paper with a discussion of prior research on gay-sounding men's voices and the difficulties that arise with attempts to delineate the precise acoustic traits that are recruited in the perception of men's sexual orientation. While some differences are likely attributable to disparate research methods, I argue that the incongruities that appear across different populations of gay-sounding men are to be expected if we take seriously the notion that more than one combination of acoustic characteristics can be perceived as equally gay-sounding. I then present my own analysis of speech from 15 men whose sexuality was rated by listeners (5 trans men, 5 gay cis men, and 5 straight cis men). In addition to confirming the significance of /s/ as a marker of men's perceived sexuality, my analysis includes new evidence for the perceptual salience of creaky voice quality as an index of sexuality (see also Podesva 2007). As Section 3 details, the trans speakers in this study were indeed grouped together with the gay cis participants by listeners. However, there are significant acoustic differences between the gay-sounding trans men and the gay-sounding cis men in this study; likewise, there is considerable variation within each of these groups. In addition to group-by-group comparisons, I also analyze variation on a speaker-by-speaker basis, which further illustrates the heterogeneity of gay-sounding speech. I close with a discussion of the implications trans men's voices present for the study of sexuality and the voice, particularly with respect to our theorization of how gay-sounding speech is acquired and the relationship between sexuality and gender normativity.

## 2. Searching for a style: Acoustic correlates of perceived sexuality

Contemporary sociophonetic research on gay-sounding voices can be traced to Gaudio's (1994) article, in which he compares the pitch properties of read speech produced by small groups of gay and straight men.<sup>3</sup> Gaudio's goal was to interrogate the assumption that gay men talk like, or even imitate, women — an idea that had been put forth speculatively in a number of discussions of language and

gender up to that point. Namely, he investigates the suggestion made by scholars like Lakoff (1975) and McConnell-Ginet (1983) that gay men's intonation tends to be more dynamic than that of straight men. Although he did not find very conclusive evidence for differences in pitch dynamism among the gay and straight men whose speech he analyzed, Gaudio did find that listeners were usually correct in guessing whether speakers identified as straight or gay on the basis of their read speech. There was certainly reason to keep looking for other salient acoustic characteristics that listeners might tap into in making these types of judgments. As research on sexuality and the voice has progressed, authors like Smyth, Jacobs, and Rogers (2003), Munson (2007, Munson et al. 2006), Levon (2006, 2007), and Campbell-Kibler (2007, 2011) have shifted toward a focus on perception over production. That is, rather than emphasizing the construction of gay or straight identities, these studies are primarily concerned with the perception of a voice as **gay- or straight-sounding** — a perception that may or may not align with speakers' sexual identities or practices. Perception is the focus of my own study as well, along with the ways perception aligns with speakers' self-identified gender and sexuality. Generally speaking, these investigations have analyzed variables associated with gender differences (e.g. pitch, the production of /s/, vowel formants) and language ideologies about gay men's voices (e.g. pitch dynamism, the "gay lisp"). Researchers consistently uncover acoustic traits that serve as predictors for a speaker's perceived sexuality. But precisely which traits correlate with perceived sexuality and which do not differs considerably across studies, with only one clear exception: the distribution of acoustic energy in /s/.

Fundamental frequency — the acoustic correlate of pitch — is one of the most commonly measured acoustic parameters in studies of gay-sounding men's voices. Often, this means comparing the mean pitch of gay- and straight-sounding speakers' read speech. While the average fundamental frequency (or F0) of American English speaking men is typically pegged at 100–120 Hz, and women's at 200–220 Hz, the mean pitch of gay and straight men has not been found to differ significantly between these groups (Gaudio 1994, Linville 1998, Munson 2007, Smyth et al. 2003, Zimman 2010). That is, gay-sounding men do not have higher pitched voices than straight-sounding men. Munson and his colleagues (2006) report a significant relationship between F0 and perceived sexuality, but Munson (2007) follows up on this finding with more refined statistical analysis of the same data that indicates fundamental frequency was not a significant predictor of a speaker's perceived sexuality once masculinity and femininity ratings are accounted for. Pitch range and variability have been a somewhat more fruitful line of inquiry, with Gaudio (1994) finding that the gay men he recorded made use of more pitch fluctuations that were equal to or greater than 10% of their average pitch. However, the other measures of pitch variability he made were not significant across the two

groups of speakers in his study. Importantly, Levon (2007) reports that manipulating pitch range affected the perceived sexuality of one of his two speakers while having no effect on the other. Smyth and his co-authors (Jacobs, Smyth & Rogers 2000, Smyth et al. 2003), by contrast, find no correlation between pitch range and perceived orientation. Despite the tendency for pitch not to prove significant in previous studies of perceived sexuality, the analysis presented below considers fundamental frequency in order to test whether trans men's pitch may differ from that of cis men.

The acoustic characteristics of vowels, too, have been a frequent object of study in research on gay-sounding voices. The gay-sounding men in Smyth et al. (2003) produced vowels with longer durations than the straight-sounding participants, but Pierrehumbert et al. (2004), Munson et al. (2006), and Piccolo (2008) find no consistent relationship between vowel duration and perceived sexuality. Other analyses are concerned with vowel quality, which can be measured by analyzing the acoustic frequencies that resonate within an individual's vocal tract. These frequencies, called formants, are based in part on the shape of the vocal anatomy. Women tend to produce vowels with higher formant frequencies than men, but studies of gay-sounding voices do not generally find associations between these frequencies and men's perceived sexuality (Jacobs et al. 2000, Linville 1998, Pierrehumbert et al. 2004, Zimman 2010). One exception to this trend is the gay-sounding men analyzed by Munson et al. (2006), who had lower fronter vowels and fronter back vowels than the straight-sounding men, though again Munson (2007) later finds that only the first formant, known as F1, correlates with perceived gayness once ratings of a speakers' masculinity and femininity are statistically accounted for. Other studies have found a correlation between perceived sexuality and vowel dispersion, which represents the distance between each vowel within the articulatory space (Pierrehumbert et al. 2004, Smyth & Rogers 2002). Greater dispersion is associated with speaker clarity, and women have been shown to make use of larger vowel spaces than men (Bradlow, Toretta & Pisoni 1996, Neel 2008). In contrast to the results of Smyth and Pierrehumbert's studies, however, Munson et al. (2006) and Piccolo (2008) find no relationship between dispersion and perceived sexuality. Both average formant frequencies (F1 and F2) and vowel dispersion are included in the analysis below.

As I mentioned above, the most consistently significant acoustic variables in studies of gay-sounding male voices are measures of /s/, reflecting the emblematic salience of sibilants in stereotypes about gay men's speech. Some studies have associated gay-sounding men's voices with a longer duration of /s/ (Linville 1998, Smyth et al. 2003, though compare Levon 2006, 2007, Zimman 2010), while others have focused on which frequencies have the greatest concentration of acoustic energy. A high frequency /s/ is produced with the tongue closer to the teeth than a

lower frequency /s/ (Fuchs & Toda 2010) — hence the notion that a high-frequency /s/ is a “lisp” — and can be measured acoustically in several ways. Scholars of gay-sounding voices have most typically looked at mean frequency (also known as center of gravity); peak frequency (i.e. the frequency with the greatest amplitude); or spectral skew (i.e. whether there is more concentrated acoustic energy in the frequencies above the mean or below it). Gender differences in the articulation of /s/ have been the subject of several studies (see Flipsen, Shrilberg, Weismer, Karlsson & McSweeny 1999 for a review), which indicate that women tend to produce this sound with higher mean frequencies, higher peak frequencies, and a more negative skew (indicating more acoustic energy in the frequencies above the mean) relative to men.<sup>4</sup> Each of these measures has also been shown to correlate with the perception of a voice as gay-sounding, though the analysis presented by Munson (Munson et al. 2006, Munson 2007) suggests that skew is a better predictor of speakers’ perceived sexuality than is center of gravity. That is, gay-sounding men do not necessarily have higher mean frequencies for /s/ than do straight-sounding men, but their production of /s/ does tend to result in more concentrated acoustic energy in the frequencies above that mean. In recognition of the articulatory basis of /s/, Campbell-Kibler (2011) describes the results of a perceptual experiment using the speech of four men whose /s/ she manipulated to include either an unmarked variant of /s/, a fronted variant, or a retracted variant. For each of these speakers, listeners were significantly more likely to rate them as gay-sounding when they heard them with a fronted /s/. In the analysis of /s/ that appears below, I include both center of gravity and skew in order to explore the possibility that one or both of these might differ between speakers who are gay- and straight-sounding, or speakers who are trans and cis.

There are several possible explanations for the inconsistencies across the studies I have just described. One of the most immediately obvious differences is in methodology: not only are different measurements taken to capture the same variable (e.g. vowel duration, vowel quality, and vowel dispersion), at times different types of language data are analyzed. Most studies on the perception of sexuality — including my own — make use of read speech, using scripts like the “Rainbow Passage” (Fairbanks 1960). However, Munson and his colleagues (Munson et al. 2006, Munson 2007) use individual words as data for their acoustic and perceptual analysis. Given that Munson and his co-authors reach several findings not reflected in studies that use sentence-level speech — specifically that both fundamental frequency and overall mean F1 predict perceived sexual orientation — their atypical findings may be due to this difference in data. Perhaps listeners who are given isolated words rely on a different set of associations than listeners presented with connected speech. Dialect differences may also play a role: the speakers from the study conducted by Smyth, Jacobs, and Rogers are speakers

of Canadian English while Munson's work deals with Americans from the upper Midwest and the speakers in Piccolo (2008) were natives of Hawai'i. Particularly for clearly dialect-linked features, like the individual vowel classes examined by Podesva et al. (2001), Pierrehumbert et al. (2004), or Zimman (2010), differences across gay- and straight-sounding speakers exist in the context of local dialect features and linguistic changes in progress. This is made especially clear by Podesva's (2011) recent work on the co-variation of dialectal and sexuality-linked traits in the style-shifting of one gay man whose use of the California Vowel Shift varies in concert with his use of falsetto voice quality and dramatic intonational shifts.

Another challenge in attempting to identify which features characterize a gay-sounding phonetic style is the messy and politically-charged relationship between sexuality and gender normativity. Several studies of perceived sexuality and the voice have asked listeners to rate speakers' masculinity or femininity/effeminacy along with their orientation. Although these sets of measures — gender normativity and sexuality — tend to correlate closely with one another, they are not identical. Gaudio (1994) mounts a strong argument against the assumption that sounding like a gay man necessarily means sounding feminine. Rather than indexing femininity directly, Gaudio argues that phonetic traits linked to women's voices can also be deployed, in different contexts, to index distinctively gay masculinities. Munson (2007), taking a similar approach, separates gay/straight ratings and masculinity/femininity ratings in order to argue that while F1 and the spectral skew of /s/ predict sexuality ratings of his speakers, it was mean F0 and F2 that predict ratings of gender normativity (i.e. masculinity or femininity). Based on this distinction, he argues that gay-sounding men do not engage in across the board imitation of women, but rather in "a selective adoption of some speech patterns characteristics of the opposite sex" (Munson 2007: 216), which together have come to index gay identity. Since other researchers have not generally integrated masculinity/femininity ratings into their statistical analyses of perceived sexuality, Munson's findings suggest that these studies might have confounded gender and sexuality rather than keeping them properly separate.

By contrast, other authors have emphasized the connections between gender and sexuality — and specifically the association between gay men and effeminacy — as a means of explaining how gay-sounding phonetic styles are acquired. Jacobs et al. (2000) point out that the phonetic features reported to separate gay-sounding men from their straight-sounding counterparts are gendered speech characteristics learned during childhood language socialization. By contrast, gender differences in the voice that are thought to arise through biological processes, like pitch, do not seem to be a consistent difference between these groups. These authors suggest that boys who do not acquire culturally normative masculine speaking styles may grow up to be perceived as gay-sounding men. Their suggestion, then, is that a less

typically masculine gender expression may pre-date the development of a self-conscious gay identity. In other words, it is gender normativity, rather than sexuality per se, that explains variation between gay- and straight-sounding speakers. Jacobs et al. (2000) suggest that the association between gay men and femininity is driven by the overlap between men who identify themselves as gay and men whose gender presentation is not normatively masculine. Regardless of how frequent non-normative masculine gender expressions actually occur among gay men, there is a clear **ideological** link between femininity and male homosexuality. When asked to provide ratings for both sexuality and gender normativity, listeners are able to distinguish these concepts, but it is less clear how carefully they might separate gender and sexuality without being prompted to do so. Indeed, the widespread conflation of gay/lesbian and transgender identities, despite activists' attempts to distinguish between these groups (Stryker 2008, Valentine 2007), points to the fact that gender and sexuality are not always easily distinguished. Although we do not want to fall into the trap Gaudio identified, of blindly assuming that gay masculinity constitutes mimicry of heteronormative femininity, there is also a danger in failing to recognize the deep and complex cultural links between gender normativity and sexuality.

The potential link between childhood gender expression and perceived sexuality in adulthood is part of what drives the centering of trans men into this study of gay-sounding voices. If learning to speak in ways associated with femininity, whether through peer groups or other sources of gender socialization, is critical in the development of gay-sounding male voice, then trans men may be especially likely to be perceived as gay. That is, trans men who have low-pitched voices by virtue of testosterone therapy but maintain other prototypically "feminine" speech characteristics may be read as gay men. Although some trans men have a history of resisting or rejecting the pressures of gender socialization early in life, others have much more normatively feminine voices before beginning their transition. The reasons for this are complex and treated at length in other spaces (Zimman 2012), but it is important to note that trans men often have complex relationships with their perceived sexuality. Being perceived as male is important to virtually all of the trans men with whom I have worked, but being perceived as a gay man elicits a wider range of reactions. Some trans men prefer to be perceived as gay or queer men because they are attracted to other men and thus consider it an appropriate characterization of their sexual orientation. Other trans men, who are exclusively attracted to women, may nevertheless see themselves as queer by virtue of their trans identity, their history in queer communities, or their relationships with queer women; for this group, being perceived as gay may be acceptable because it is preferable to being perceived as a straight cis man. By contrast, however, some trans men see themselves as straight men, and may prefer to be seen that way by others.

Given this varying relationship between gender and sexuality among trans men, I hypothesize that trans men of different sexual orientations may be grouped together as gay-sounding by virtue of their early life socialization experiences, their identification with queer masculinities, or both. Trans people highlight the intertwined relationship between gender and sexuality that proves useful as a way of exploring how hegemonic masculinity shapes the perception of men's voices.

With the sociocultural linkages between gender and sexuality in mind, it seems unlikely that linguists could uncover a clear and absolute division between variables that index sexuality and those that index gender. Indeed, the practice of assigning specific social meanings to individual features runs contrary to the emphasis scholars of style have placed on the bundling of sociolinguistic variables. There are two studies in the literature on sociophonetics and sexuality that provide strong evidence for the importance of stylistic context. Levon's (2007) perceptual experiment using digitally manipulated speech from two speakers shows that shrinking the pitch range of the gay-sounding speaker he recorded was enough to change the way listeners perceived his sexuality. However, increasing the pitch range of the straight-sounding speaker did not raise his gayness ratings significantly, presumably because factors other than pitch range differentiated these two speakers. Levon's analyses also indicate that it was specifically the interaction between pitch range and /s/ duration that predicted how speakers would be rated on a scale of masculinity versus effeminacy. Rather than working in an additive manner, then, the acoustic characteristics that index gender and sexuality take on meaning only in relation to one another. Campbell-Kibler's (2011) recent work describes a similar matched guise experiment in which utterances from four different speakers were altered to include different combinations of features that have been linked to sexuality: a fronted or retracted /s/, a higher or lower fundamental frequency, and *-ing* versus *-in'* as pronunciations of the suffix *-ing* (see Campbell-Kibler 2007). While the correlation between /s/ fronting and sexuality was stable across Campbell-Kibler's speakers and guises, there were also more context-sensitive associations — like the one between /s/ fronting and *-ing*, which together worked to evoke an image of the "smart, effeminate gay man" (Campbell-Kibler 2011:64). While *-ing* on its own could not be said to index gayness, it is in relation to other features that this variable takes on a complex social meaning inflected by sexuality in relation to other features.

The approach of looking for consistencies among gay-sounding speakers remains a significant part of the literature on sexuality and the voice — and for good reason. The fact that numerous studies have found /s/ to be consistently associated with perceived sexuality says a great deal about the salience of this feature, as Campbell-Kibler (2011:64) also discusses. But even as we uncover inter-speaker commonalities among men perceived as gay-sounding, it is equally important

for us to pursue analyses of variation between gay-sounding speakers. With the recognition that there are multiple speaking styles that can be perceived as gay-sounding, it becomes clear that a search for a single, cohesive gay-sounding speaking style limits our ability to understand the full diversity of gay-sounding speech. This in turn keeps us from seeing how the linguistic categorization of certain voices as gay-sounding and others as straight-sounding helps to define the boundaries of hegemonic masculinity.

The notion that there is more than one type of gay-sounding voice aligns with gender theorists' accounts of hegemonic masculinity as a form of masculinity that stands at the top of the ideological gender hierarchy. In our efforts to understand gendered power dynamics, pioneers of masculinity studies like Connell (1995) have argued that it is crucial to understand not only the hierarchical relationship between women and men, but also the differential power and value granted to certain forms of masculinity over others. Hegemonic masculinity, then, consists of the narrow range of masculinities that are most valued in a particular cultural context, necessarily producing numerous kinds of subordinated masculinities. Gayness, having been "symbolically expelled from hegemonic masculinity" (Connell 1995:78), can serve as a catch-all category for stigmatized forms of male gender expression. Men and boys who are derided for being "gay" may be attracted to men, of course, or they may be singled out because they are perceived as insufficiently masculine (Pascoe 2007), whether because they are emotionally expressive, less than stellar athletes, or self-identified nerds (see, for instance, Bucholtz 2001, Cameron 1997, Kiesling 2002). It is on this basis that authors like Zwicky (1997) and Barrett (1997) have posited that any phonetic style failing to meet the expectations of heteronormative (i.e. hegemonic) masculinity can be lumped together as "gay."

The research I have just described provides strong evidence that listeners can and do tap into different sets of acoustic cues in identifying speakers as gay- or straight-sounding. My focus in this section on stylistic context leads naturally to questions about speaking context and whether perceptions of read speech produced in experimental contexts reflects the way sexual orientation is perceived and negotiated in everyday interaction. The addition of visual semiotics and discourse content would surely make these perceptual processes exponentially more complex. At the same time, the fact that listeners are willing to make judgments about the sexual orientation on the basis of decontextualized voices is worthy of study in its own right. The choice to use read speech for the study I present below was motivated in part by a desire to provide results comparable to previous studies of gay-sounding voices and in part to minimize the possibility that listeners would rely on the content of spontaneous speech in making their judgments of speakers' sexualities, making it harder to pinpoint the sociophonetic contribution of these perceptions. Smyth et al. (2003) found that their listener subjects were accurate

in identifying speakers' identities as gay or straight based on a written transcript of gay and straight speakers' spontaneous speech, even when the discourse topics appeared to be "neutral" with respect to sexuality.

The perceptual experiments I have carried out provide some further support for the idea that *gay-sounding* and *straight-sounding* are relevant to listeners as perceptual categories, even outside of situations where sexuality might seem to be contextually relevant. As part of the analyses I discuss below, as well as the pilot study (Zimman 2010) for this project, listeners who provided ratings on the sexual orientation of each speaker were given the opportunity to say that they had "no idea" whether a speaker was gay or straight. While some listeners chose this option for individual speakers, none were consistently unwilling or unable to judge speakers' sexual orientations. In contrast, as part of the pilot study for this project, I also asked listeners whether the speakers they heard sounded like they had blue or brown eyes, and whether they preferred to spend time in the mountains or by the ocean, in order to test whether listeners would be willing to make judgments about characteristics that are presumably not indexed linguistically. Only two of the eight pilot listeners attempted to guess the eye color of one or more speaker while the other six chose the "no idea" response for every speaker. On the other hand, all eight of these listeners gave sexual orientation ratings to more than half of the speakers they heard. Just as listeners are willing to judge speaker gender based on decontextualized speech (and typically do so accurately, even with a degraded acoustic signal, as in Lass, Hughes, Bowyer, Waters & Bourne 1976), listeners do appear to be comfortable making perceptual judgments about men's sexual orientation, based on their voices.

In the next section, I present more details about my analysis of gay-sounding voices among trans and cis men as a means of exploring stylistic variability among gay-sounding men. I then discuss the ways trans men can inform our understanding of the broader relationship between gender, sexuality, and the voice.

### 3. Trans men and gay-sounding voices

I turn now to an analysis that helps to illuminate the question of whether different combinations of phonetic features might elicit similar perceptions among listeners. Here I analyze a selection of gendered sociophonetic variables that include both features influenced by biological forces (e.g. pitch) and those driven by more clearly social processes (e.g. /s/). The study presented in this section centers around an acoustic and perceptual analysis of trans and cis men's voices. Although relatively little research has been carried out on the voices of trans men (Papp 2011, van Borsel et al. 2000, Zimman 2012), it is clear that testosterone therapy typically

causes a marked drop in vocal pitch along with other forms of physical masculinization. Longitudinal studies carried out by Papp (2011) and Zimman (2012) show that the changes in vocal pitch trans men experience the first year on testosterone usually gave them access to an unambiguously male-sounding pitch range.

Yet many of the gendered characteristics of the voice are socially learned. Even as linguists have looked for anatomical differences between the sexes that could explain gender differentiation in /s/ (e.g. Fuchs & Toda 2010), to take one of the examples relevant to this study, the evidence as a whole indicates that these patterns arise from articulatory habits learned early in life, which vary across communities. Flipsen et al. (1999) show that gender differences in /s/ appear during childhood, prior to pubertal changes in the vocal tract. In an examination of gender and class as intersecting subjectivities, Stuart-Smith (2007) finds that the /s/ of working-class girls in Glasgow resembled those of adult men while the middle-class girls' productions were like adult women's. In a cross-linguistic comparison, Gordon, Barthmaier and Sands (2002) indicate that gender differences in /s/ appeared in only one of seven unrelated languages they analyzed (Chickasaw). Zimman's (2012) analysis of trans men's production of /s/ further points to the importance of identity and socialization experiences over biology.

A final variable in the present analysis, which has a murkier relationship with sexual biology, is voice quality. While pitch is a measure of how quickly the vocal cords vibrate, voice quality references the mode of vibration. My interest here is in creaky voice (sometimes referred to as *vocal fry*), a prevalent feature in the sociolinguistic styles of trans men in the communities where I have worked. In the production of creaky voice, cartilage at the front and back of the larynx are brought close together, leaving the vocal folds loose and slack. The folds then vibrate at a very slow rate, allowing each glottal pulse to be heard individually, which creates a slow creaking sound. Henton and Bladon's (1988) analysis of gender and creak among speakers of British English found greater prevalence of this voice quality among men, serving as an oft-cited reference on the gendered meaning of creak. The social meanings currently attached to creaky voice quality in American English, however, are only beginning to be explored. Notably, Yuasa's (2010) study of this laryngeal setting in the speech of American women and men, in comparison to Japanese women, forms the basis of her argument that creak has recently taken on an association with young, urban-oriented, upwardly mobile women in the United States. Despite its absence from the perceptual literature on sexuality, creaky voice has been the subject of sociophonetic analysis in Podesva's (2007) study of stylistic variation in the voice quality deployed by one gay speaker. This speaker employed creaky voice in concert with falsetto voice quality, which represents extremely low F<sub>0</sub> and extremely high F<sub>0</sub>, respectively. As Podesva points out, together these voice qualities create a much more expansive pitch range than

modal voice quality alone could provide. In the case of trans speakers, Zimman (2012) discusses the presence of creaky voice quality in the sociolinguistic styles of trans men who participated in my longitudinal study, though it is not entirely clear whether their use of creak is better explained by virtue of changes in the larynx or whether it is driven by more purely social processes.

Trans men, then, can provide a unique set of insights on the various ways that gendered phonetic traits can be combined and re-combined, including biologically-influenced variables (like pitch) and those that arise primarily or exclusively through gendered language socialization (like the articulation of /s/). Trans speakers thereby carry great potential to inform our understanding of how gendered phonetic styles are acquired and how they can change across the lifespan; I return to this matter in the discussion section below.

### 3.1 Methods

In order to compare the perception of sexual orientation among trans and cis men, I designed a study based in part on the methods detailed by Smyth et al. (2003). In addition to recruiting gay- and straight-identified men from the University of Colorado's student population, I also conducted interviews with self-identified trans men as part of the early stages of an ethnographic project on the phonetic styles of people on the female-to-male transgender identity spectrum. Five speakers from each of these groups — straight cis men, gay cis men, and trans men with a variety of sexual orientations — were included for the analysis presented here based on their region of origin and self-described sexuality (see Table 1). All speakers came from urban or suburban parts of Colorado or California, were college educated, and described themselves as middle-class. Their ages ranged from 19 to 51, though it is worth noting that the average age of the trans speakers (29.4 years) and gay speakers (31.2 years) was higher than the average age of the straight speakers (22 years). Most participants were white, which is a point addressed below along with perceptual results. Among the cis speakers, all participants chose the labels *gay* or *straight* when asked about their sexual orientation. Four out of the five transgender speakers, by contrast, made use of the word *queer* rather than either *gay*, *straight*, or *bisexual*, when describing their sexuality. For these trans men, *queer* takes on a variety of potential meanings: for John and Phil, an affiliation with queerness reflects their attraction to other men. Erik and David, on the other hand, applied the label *queer* to their relationships with women. Many trans men do self-identify as *gay*, by virtue of their attraction to men and only men, but none of the participants in this study fit this description. One of the five trans men, AJ, is attracted only to women and describes himself as a straight man.

Table 1. Demographic information for each speaker

Group (self-described)	Speaker pseudonym	Age	State	Ethnicity (self-described)	Sexuality (self-described)
Gay cis men	Craig	31	CA	White	Gay
Gay cis men	Matthew	24	CO	White	Gay
Gay cis men	Jim	49	CA	White	Gay
Gay cis men	Bob	20	CA	Latino	Gay
Gay cis men	Tom	32	CO	White	Gay
Straight cis men	Drew	23	CO	White	Straight
Straight cis men	Kirk	20	CO	White	Straight
Straight cis men	Pete	20	CA	Asian	Straight
Straight cis men	Fritz	20	CA	White	Straight
Straight cis men	Connor	27	CA	White	Straight
Trans men	Phil	24	CA	White	Queer
Trans men	Erik	19	CA	White & Filipino	Queer
Trans men	David	51	CA	White	Queer
Trans men	John	22	CO	White	Queer
Trans men	AJ	31	CA	White & Iranian	Straight

When I met with each of these participants, I began by asking them to read the Rainbow Passage (see Appendix), which has been used in several studies of gay-sounding voices. During this stage of our interaction, speakers were not aware of my focus on gay-sounding voices; instead, the cis speakers were told only that they were participating in a study on men from “different backgrounds” who are natives of Colorado or California. However, the trans participants knew that they were being recorded as part of the initial stages of a study on trans men because of the special efforts needed to recruit these individuals. Of course, despite my efforts to conceal the exact purpose of the study, it is entirely possible that the speakers were thinking about the gendered characteristics of their voices while reading into a microphone for a researcher, perhaps especially in the case of the trans men. After recording participants’ reading of the Rainbow Passage, I interviewed them on a number of topics ranging from rather mundane details about their lives (e.g. “what kinds of kids did you hang out with in high school?” or “how did you decide to study journalism?”) to questions about speakers’ identities (e.g. “do you consider yourself a pretty typical guy’s guy?” or “how did you come to realize that you’re trans?”) to requests for metalinguistic commentary (e.g. “would you say you can usually guess someone’s sexual orientation based on their voice?” or “what do you think of your own voice?”). After the interview, participants were fully informed

about the goals of the project and allowed at that point to decide whether they wanted their voices to be included for analysis. All opted for inclusion when presented with this choice.

From the 15 recordings of the Rainbow Passage made by the speakers I have just described, I segmented identical excerpts of approximately 30-seconds from the middle of the text. These portions were used for both acoustic analysis and for collecting listener ratings, which is discussed below. In this analysis, I focus on seven acoustic characteristics: mean fundamental frequency, the first and second formant frequencies (F1 and F2), vowel dispersion, creaky voice quality, and the frequency profile of /s/ as measured by center of gravity and spectral skew.

Most of these measurements, including F0, F1, F2, and vowel dispersion, are based on 50 stressed vowels in the selected segment of the Rainbow Passage, which were chosen on the basis of their phonetic environment (vowels surrounded by liquid or rhotic consonants, i.e. /l/ and /r/, were excluded). Measurements of monophthongs were taken at the vowel mid-point, while diphthongs were measured at the 25% and 75% points; only diphthong nuclei are incorporated into the present analysis. All measurement points were checked and manual adjustments were made as needed. Using this same set of measurements, the degree of vowel dispersion was determined for each speaker on the basis of the mean Euclidean distance of each vowel token from the center of that individual's vowel space. Formant values were normalized according to the Lobanov method using the web-based NORM Suite (Thomas & Kendall 2007) in order to capture relative differences in the vowel systems of different speakers while factoring out variation based on physiological characteristics like vocal tract length. It is not entirely clear whether judgments of a voice as gay-sounding are based on the relative distance between vowels or whether it is the absolute formant values that matter. However, an alternative model that used unnormalized vowel formants provided results nearly identical to those appearing in Table 3.

Creaky voice was measured as the number of words in the passage (out of 110 in total) with both an audible creaky quality and visually identifiable creak in the spectrogram. Creak appears visually in the form of irregularly spaced, low frequency pulses, each of which represents one cycle of vibration in the vocal folds. Every word that was produced partially or entirely with creaky voice quality was marked as displaying creak for the purposes of this analysis, while all other words were categorized as non-creaky.

Finally, the spectral qualities of /s/ were investigated through analysis of 17 tokens of /s/ from each speaker's passage. Following other linguists working with sibilant consonants (e.g. Flipsen et al. 1999), spectral slices were generated at the consonant's midpoint and subjected to statistical analysis using Praat's automated moments analysis function. A moments analysis provides a weighted mean

frequency known as center of gravity; it also generates a measure of skew, which indicates whether there is more acoustic energy in the frequencies above the mean or below it. A negative skew (i.e. below 0) indicates more energy in the higher frequencies, while a positive skew (above 0) indicates more energy in the lower frequencies. As I described above, the review put forth by Flipsen and his colleagues indicates that studies of gendered /s/ productions tend to find women produce /s/ with a higher center of gravity and a more negative skew. According to their summary of research on /s/ in connected speech, men's range for center of gravity or peak frequency tends to be in the range of approximately 4,000–7,000 Hz, while women's tends to be in the range of 6,500–8,000 Hz. Likewise, gay-sounding male voices have been linked to both higher centers of gravity and more negative skews than their straight-sounding counterparts.

The same 30 second clips used for acoustic analysis were also used to elicit perceptions from listeners. An online survey was constructed that asked volunteers to listen to a group of 15 men's voices and provide judgments about each speaker's age, height, sexual orientation, and ethnicity on 5 point scales. For example, the choice for sexual orientation asked whether the speaker sounded "definitely gay," "probably gay," "in between," "probably straight," or "definitely straight." Listeners were also given the option to select "no idea." Participants were recruited from the University of Colorado student body and two academically-oriented online communities. 43 native speakers of American English completed the survey and responses were averaged so that each speaker ended up with a mean gay-sounding score between 1 and 5 (where numbers closer to 1 correspond with more "straight" ratings and numbers closer to 5 with more "gay" ratings). Listeners were told that they would hear a series of men's voices, which was reinforced up with the use of male pronouns in the questions throughout the survey. This priming was important to avoid the possibility that some speakers might be perceived as female, which would of course affect the framing of perceived sexual orientation.

In open-ended response fields, 36 of the listeners in this study identified their gender as *female* or *woman*, while only 7 identified themselves as *male*. When it came to self-identified sexual orientation, 24 of the women described themselves as *straight* or *heterosexual*, 9 as *bi* or *bisexual*, 2 as *queer*, and 1 as *lesbian*; 4 of the men identified themselves as *straight/heterosexual*, 1 as *90% straight*, and 1 as *gay*. I have already noted that listeners may have different ideas about what constitutes a gay-sounding voice based on any number of factors, including their own affiliation with LGBTQ communities, though Munson (2007) describes results from a master's thesis that notably reports no difference in straight versus LGB listeners' ability to accurately identify men's self-identified sexual orientations (Carahaly 2000). Of course, what is important for the present analysis is not the notion of accuracy, nor

achieving a representative sample of perceptual judgments, but rather the relative ratings given to the speakers in this study by one group of listeners.

Perceived ethnicity was included in the perceptual analysis in part because of the non-uniformity in speakers' ethnoracial identities: one of the straight cis speakers is Asian, one gay cis speaker is Latino, and two of the trans speakers described themselves as belonging to more than one ethnic category (in one case Filipino and white and in the other case Iranian and white). However, I found no correlation between perceived and actual ethnicity among these speakers — in fact, the people of color in the study were consistently rated as “white” (given the dichotomy “white” vs. “person of color”). Although my analysis did not capture the ways that these speakers engage linguistically with constructs of ethno-racial identity, this is not to say that these positionalities are absent from their phonetic styles. Indeed, the absence of in-depth analysis of race from the great majority of research on sexuality and the voice is one of the most significant shortcomings of this body of work, and the present paper regrettably contributes toward that trend.

After collecting acoustic and perceptual data, I performed a series of statistical analyses with the R software package (R Development Core Team 2009) to explore the relationship between perceived sexuality and the acoustic characteristics listed above. First, I constructed a linear mixed effects model using speakers' gayness ratings as the dependent variable and the acoustic characteristics I measured as fixed effects: F0, F1, F2, vowel dispersion, center of gravity for /s/ and skew for /s/. Word was used as a random effects variable. In other words, these statistical analyses model the degree to which variation in each acoustic measure can predict variation in speakers' gayness ratings. As a follow up on the regression analysis, I carried out post hoc one-way ANOVAs to examine group differences in each of the seven acoustic measures. In these ANOVAs, each acoustic variable was used as a dependent variable while group was used as the independent variable. Tukey's test determined the significance of differences between each pair of groups: the straight cis men versus the gay cis men, the gay cis men versus the trans men, and the straight cis men versus the trans men. To compare the perceptual data collected on these speakers, another linear mixed-effects regression was carried out, with gayness ratings as the dependent variable, group membership as the only fixed effects variable, and speaker as a random effects variable.

### 3.2 Perceptual and acoustic findings

The analyses I have just described put us in the position to answer some of the questions about trans men introduced above: first, were the trans men in this study perceived as gay-sounding based on their read speech? Second, which acoustic properties correspond with the perception of these men's voices as gay- or

straight-sounding? And third, are there acoustic differences between the voices of the trans and the cis men, even if they are perceived similarly?

To address the first question, an analysis of the ratings given to these 15 speakers indicates that the trans men in this study were indeed grouped together with the gay cis men as having gay-sounding voices. The linear mixed-effects model just described indicates that the gay men were significantly more gay-sounding than the straight men ( $p < 0.001$ ), as were the trans men ( $p < 0.001$ ), while the differences between the trans men and the gay men did not reach statistical significance ( $p = 0.088$ ); see Table 2 for means and Figure 1 for a box-plot of these ratings. As Figure 1 illustrates, the ratings given to the gay group were more dispersed over the full range of observed responses than those given to the trans men, but the means were not significantly different from one another.

Ratings of these speakers' perceived orientation can now be analyzed in relation to the acoustic properties I measured. A primary goal of this project is to consider both the similarities and differences between the voices of the trans and cis men who participated in this project, but it is worth noting from the outset that in most ways the group of trans speakers in this study were statistically indistinguishable from the cis men, at least when it comes to the acoustic measures I analyzed. For this reason, I begin with the variables that were associated with perceived sexual orientation across all 15 of the speakers in this study.

**Table 2.** Mean gayness ratings by speaker and group

Speaker group	Speaker	Mean gayness rating (1=straight, 5=gay)
Gay	1. Craig	3.93
Gay	2. Matthew	3.06
Gay	3. Jim	3.05
Gay	4. Bob	3.00
Gay	5. Tom	2.94
Straight	6. Drew	2.20
Straight	7. Kirk	1.95
Straight	8. Pete	1.89
Straight	9. Fritz	1.81
Straight	10. Connor	1.73
Trans	11. Phil	3.59
Trans	12. Erik	3.07
Trans	13. David	2.59
Trans	14. John	2.38
Trans	15. AJ	2.26

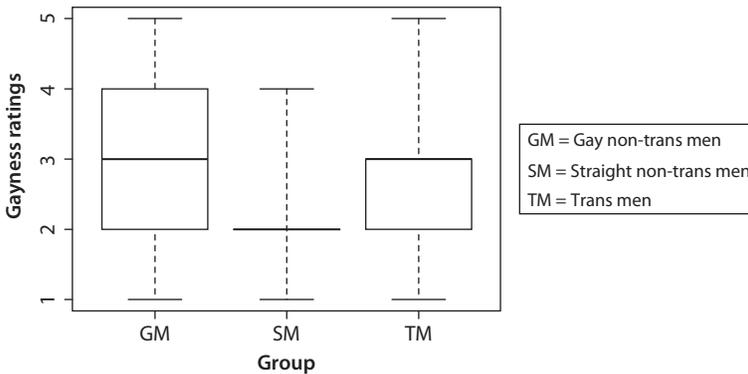


Figure 1. Gayness ratings by group

Table 3 contains the results of the linear mixed effects model designed to capture the relationship between speakers' perceived sexual orientation and the acoustic characteristics of their voices. The statistically significant acoustic parameters explain a significant amount of the variance in speakers' perceived sexuality. A positive value in the coefficient column indicates a positive correlation with perceived gayness, where high numbers correspond with gay-sounding ratings and low numbers with straight-sounding ratings; a negative coefficient indicates a negative correlation.

Three of the acoustic characteristics included in the model prove to be statistically significant predictors of perceived sexuality, as Table 3 indicates. These include mean F0, creaky voice quality, and the spectral skew of /s/. Contrary to stereotypes about gay men using high pitched voices, in this group of speakers the gay-sounding men had significantly lower-pitched voices than did the straight-sounding men. Looking at the means for F0 of each individual speaker, which appear in Table 4, we can see that both the trans group and the gay group include several speakers with particularly low-pitched voices. Among the trans speakers,

Table 3. Linear mixed effects model

<i>Acoustic parameter</i>	<i>Coefficient</i>	<i>Standard error</i>	<i>t value</i>	<i>P value</i>
Mean F0	-0.0051	0.0017	-3.034	0.003 **
Words with creak	0.2471	0.1011	2.444	0.015 *
F1 (normalized)	-0.0869	0.0488	-1.782	0.076
F2 (normalized)	-0.1187	0.0635	-1.869	0.063
Vowel dispersion (mean distance)	0.0521	0.0643	0.810	0.419
Center of gravity	0.0000	0.0000	0.226	0.822
Skew	-0.3452	0.0565	-6.106	0.000 ***

Note: \* indicates significance at the 95% confidence level; \*\* at the 99% confidence level; \*\*\* at the 99.9% confidence level.

Phil and Erik both had relatively high gayness ratings and relatively low means for F0 (91 Hz and 102 Hz, respectively). The gay speakers Matt and Bob fall into this group as well (with means of 103 Hz and 85 Hz, respectively). By contrast, by far the highest mean F0 for this group was produced by straight speaker Pete (156 Hz).

The amount of creaky voice quality occurring in each speaker's reading of the Rainbow Passage also differed significantly across the gay- and straight-sounding speakers. That is, the gay-sounding men produced a greater number of words in the passage with creaky voice than did the straight-sounding men. Each speaker's total number of words produced with creaky voice quality also appears in Table 4.

Because creaky voice quality is produced through low frequency vibration of the vocal chords, it is unsurprising that some of the speakers with low means for fundamental frequency also often make use of more creaky voice quality than do the speakers with higher fundamental frequencies, such as Pete and Jim. However, this relationship is not absolute; for instance, among the trans men, Phil has the lowest fundamental frequency, but Erik and AJ make more consistent use of creaky voice than Phil. More strikingly, Tom made great use of creaky voice despite having one of the highest means for fundamental frequency among all 15 speakers (though his mean of 127 Hz is not exactly high-pitched). Furthermore, an alternative regression model that included potential interactions between F0 and creaky voice (and between center and skew for /s/) found no significant interactions. The

**Table 4.** Fundamental frequency mean and number of words with creak, by speaker

<i>Group</i>	<i>Speaker</i>	<i>Mean gayness rating</i>	<i>Mean F0</i>	<i>Creaky words (out of 110)</i>
Gay men	1. Craig	3.93	115 Hz	30
	2. Matthew	3.06	103 Hz	47
	3. Jim	3.05	120 Hz	4
	4. Bob	3.00	85 Hz	83
	5. Tom	2.94	127 Hz	53
Straight men	6. Drew	2.20	109 Hz	16
	7. Kirk	1.95	105 Hz	28
	8. Pete	1.89	156 Hz	0
	9. Fritz	1.81	113 Hz	8
	10. Connor	1.73	111 Hz	15
Trans men	11. Phil	3.59	91 Hz	44
	12. Erik	3.07	102 Hz	74
	13. David	2.50	129 Hz	22
	14. John	2.38	123 Hz	30
	15. AJ	2.26	97 Hz	60

correlation coefficients produced by R's linear mixed-effects regression function estimate the correlation between creak and mean F0 at  $r = 0.393$ , which is not significantly different from zero ( $t = 1.541, p = 0.147$ ).<sup>5</sup>

Finally, in keeping with other studies of perceived sexual orientation, skew is inversely correlated with gayness ratings, indicating that gay-sounding speakers produced /s/ with a more negative skew (i.e. a skew toward higher frequencies) when compared to the straight-sounding men. Table 5 contains the means for each speakers' center of gravity and skew for /s/. While the center of gravity is given in Hertz, skew is represented as a number that indicates distance from 0. Only Jim and Craig, both gay cis men, have a negative mean skew, but smaller positive values also indicate greater acoustic energy in higher frequencies relative to larger positive values. For our purposes, it is the relative difference between speakers' skew that matters most. Although the system for measuring skew treats 0 as an absolute point of reference, keep in mind that phonetic context affects the frequency spectrum of a sound like /s/. It is possible that the particular tokens of /s/ measured for this analysis tend to trend toward the lower frequencies (positive skew) because of their phonetic contexts, for instance. In any case, we should not infer that because Jim and Craig are the only speakers with a negative mean skew that Jim and Craig are the only speakers who produce a gay-sounding /s/.

**Table 5.** Center of gravity and skew for /s/, by speaker

<i>Group</i>	<i>Speaker</i>	<i>Mean gayness rating</i>	<i>Center of gravity for /s/</i>	<i>Skew for /s/</i>
Gay men	1. Craig	3.93	7035 Hz	-0.5927
	2. Matthew	3.06	6792 Hz	0.6896
	3. Jim	3.05	5869 Hz	-0.5577
	4. Bob	3.00	6708 Hz	0.3609
	5. Tom	2.94	7229 Hz	0.8049
Straight men	6. Drew	2.20	6179 Hz	1.1485
	7. Kirk	1.95	5609 Hz	0.7087
	8. Pete	1.89	7182 Hz	0.4547
	9. Fritz	1.81	5779 Hz	1.2623
	10. Connor	1.73	6628 Hz	0.6816
Trans men	11. Phil	3.59	6659 Hz	0.5916
	12. Erik	3.07	5626 Hz	0.1439
	13. David	2.50	5576 Hz	0.6675
	14. John	2.38	6633 Hz	0.9953
	15. AJ	2.26	5803 Hz	0.4310

The other four acoustic variables included in the model from Table 3 — mean F1, F2, vowel dispersion, and center of gravity for /s/ — do not predict a significant amount of the variance in sexuality ratings for the speakers in this study, taken as a whole. Mean values for F1, F2, and vowel dispersion appear in Table 6 for reference, while center of gravity means are included in Table 5.

**Table 6.** Means for F1, F2, and vowel dispersion, by speaker (normalized)

<i>Group</i>	<i>Speaker</i>	<i>Mean gayness rating</i>	<i>Mean F1</i>	<i>Mean F2</i>	<i>Vowel dispersion</i>
Gay men	1. Craig	3.93	0.0983	-0.0215	1.2980
	2. Matthew	3.06	0.0327	-0.0570	1.0662
	3. Jim	3.05	-0.0389	-0.0576	1.1950
	4. Bob	3.00	0.1380	0.0177	1.2000
	5. Tom	2.94	0.0868	-0.0243	1.1869
Straight men	6. Drew	2.20	0.1280	-0.0059	1.1664
	7. Kirk	1.95	0.0957	-0.0308	1.1988
	8. Pete	1.89	0.1064	-0.0183	1.2056
	9. Fritz	1.81	0.0624	0.0409	1.1893
	10. Connor	1.73	0.1132	-0.0728	1.2199
Trans men	11. Phil	3.59	0.1212	0.0080	1.1860
	12. Erik	3.07	0.0220	-0.0107	1.1435
	13. David	2.50	0.0256	-0.0133	1.1584
	14. John	2.38	0.0742	-0.0021	1.2571
	15. AJ	2.26	0.0437	-0.0289	1.2516

In some ways, then, the findings just reported confirm the conclusions of previous studies. Specifically, they further bolster other researchers' findings that /s/ is a perceptually salient index in the linguistic categorization of men's sexuality, and that spectral skew is a useful measure to capture this variation. Additionally, the significance of creaky voice quality in this study adds perceptual evidence for the notion that creaky voice quality constitutes a resource for indexing sexuality, as Podesva (2007) suggests. As in other studies of men's perceived sexuality that use connected speech data, the above analysis also indicates that neither F1 nor F2 differed significantly across the gay- and straight-sounding speakers. Finally, despite the statistical significance of the correlation between mean fundamental frequency and perceived sexuality in the analysis above, the fact that the correlation is a negative one supports other studies' conclusion that a higher pitched voice is not necessarily more gay-sounding than a lower pitched one.

In a few ways, however, the findings presented so far depart from those of other studies. First, there is the fact that mean F0 differed significantly across the

gay- and straight-sounding men, which has not been reflected in other studies. Second, there is the fact that vowel dispersion did not prove to be a significant predictor of perceived sexual orientation for these speakers, despite its significance in Smyth and Jacobs (2002) and Pierrehumbert et al. (2004). Most importantly, a by-group analysis of these speakers will reveal even more divergence in the phonetic styles they employ, as the next subsection details.

### 3.3 Analysis by group

The third question I introduced at the beginning of this section was whether the voices of trans men and gay-sounding cis men are as similar acoustically as they are perceptually. Table 7 presents the results of seven ANOVA models that compare the realization of each acoustic variable across the three groups of speakers (trans men, gay cis men, and straight cis men), as well as pair-wise comparisons of each group with the two others.  $\alpha$  was adjusted to 0.007 to compensate for the affects of multiple comparisons.<sup>6</sup> The first column in Table 7 indicates whether there are any significant group differences, across all three groups, for each acoustic measure that appeared in the regression model. All of the significant factors from Table 3 are also significant in Table 7: mean F0, number of words with creaky voice quality, and skew for /s/. F1, F2, and vowel dispersion show no significant group differences. The one difference from the results in Table 3 is that here center

**Table 7.** Results of group-based ANOVAs, by acoustic variable

<i>Acoustic parameter</i>	<i>ANOVA by group</i>	<i>Straight vs. gay men</i>	<i>Trans vs. gay men</i>	<i>Trans vs. straight men</i>
Mean F0	$F(2,747) = 6.354$ $p < 0.002 \dagger$	$p < 0.001 \dagger\dagger$	$p = 0.163$	$p = 0.191$
Words with creak	$F(2,1647) = 75.84$ $p < 0.001 \dagger\dagger$	$p < 0.001 \dagger\dagger$	$p = 0.651$	$p < 0.001 \dagger\dagger$
F1 normalized	$F(2,747) = 0.085$ $p = 0.919$	$p = 0.971$	$p = 0.983$	$p = 0.912$
F2 normalized	$F(2,747) = 0.044$ $p = 0.957$	$p = 0.992$	$p = 0.953$	$p = 0.984$
Mean distance normalized	$F(2,747) = 0.258$ $p = 0.773$	$p = 0.878$	$p = 0.975$	$p = 0.763$
Center of gravity	$F(2,249) = 11.75$ $p < 0.001 \dagger\dagger$	$p < 0.007 \dagger$	$p < 0.007 \dagger$	$p = 0.198$
Skew	$F(2,249) = 22.11$ $p < 0.001 \dagger\dagger$	$p < 0.001 \dagger\dagger$	$p < 0.001 \dagger\dagger$	$p = 0.031$

Note: With an adjusted  $\alpha$  of 0.007,  $\dagger$  indicates significance at the 99.3% confidence level;  $\dagger\dagger$  at the 99.9% confidence level.

of gravity differs significantly by group even though it does not correlate with gay-ness ratings across the full set of 15 speakers; this is a point to which I return momentarily. The next three columns indicate precisely which groups differed significantly from each other, based on repeated one-way ANOVAs. The results of these analyses can give us insight on whether voices of the trans men and those of the gay-sounding cis men are as stylistically similar as their perceived sexuality ratings would suggest.

As Table 7 shows, there are cases in which trans and gay cis speakers pattern together, both differing significantly from the straight cis men. When it comes to voice quality, both the gay men and the trans men make use of significantly more creaky voice than the straight men ( $p < 0.001$  in both cases), while there is no significant difference in the amount of creak produced by the trans men and the gay men. Figure 2 shows the percentage of words with creaky and non-creaky voice quality across the three groups. The dark portion of the bars represents the use of non-creaky (typically modal, or unmarked) voice quality, while the light portion represents creaky voice. For both the gay men and the trans men, approximately 40% of the words produced contained creaky voice quality (39% for the gay men, 42% for the trans men). The straight men, on the other hand, used creak for only 12% of the words they collectively produced.

In other ways, the trans and gay cis speakers differ from one another. Most significantly, the trans men pattern with the straight men when it comes to center of gravity for /s/; the gay men had significantly higher centers of gravity than either the straight men or the trans men ( $p < 0.007$  in both cases), as Figure 3 illustrates. Yet there is no significant difference between the centers of gravity produced by the straight men and trans men. This can be seen most clearly by comparing the

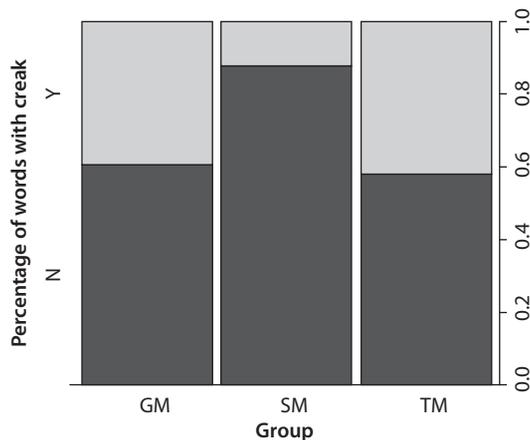


Figure 2. Creak by group

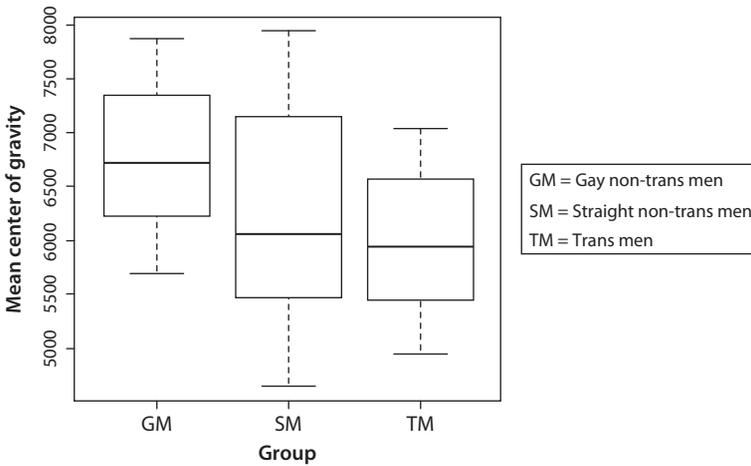


Figure 3. Mean center of gravity by group

group means, represented by the bars in the middle of the box-plots in this figure. Interestingly, the straight cis men had the largest range of values for center of gravity, and it was the trans men who produced the most consistently low centers of gravity compared to either group of cis speakers.

Finally, there are two cases in which the trans men fall somewhere between the gay and straight cis men. In the case of pitch, the gay cis men have significantly lower mean fundamental frequency than the straight cis men ( $p < 0.001$ ). The trans men, however, do not differ significantly from either group of cis men. Figure 4 shows the trans men covering nearly as large a range as the gay men, but with a slightly higher mean than either of the cis groups.

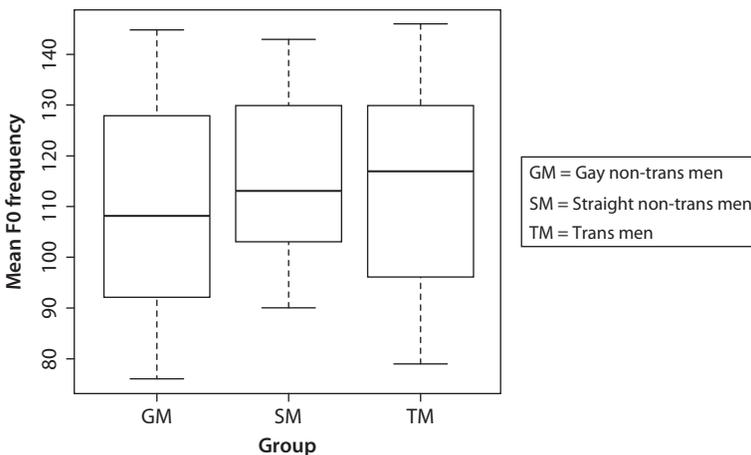


Figure 4. Mean F0 by group

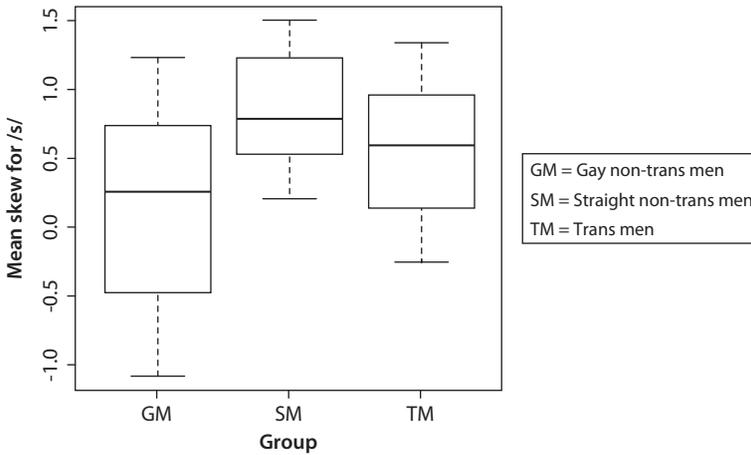


Figure 5. Skew by group

Similarly, when it comes to the spectral skew of /s/, there are differences between all three groups, with the trans men situated between the two cis groups (see Figure 5). Speakers in the gay group had significantly more negative values for skew than those in the straight group ( $p < 0.001$ ), indicating that the gay men tended to produce /s/ with more acoustic energy in the higher frequencies. The gay men also had significantly more negative means for skew than the trans men. While the trans men's range of productions puts them somewhere between the gay and straight cis men, the difference between the trans and straight speakers did not quite reach significance with the adjusted  $\alpha$  used for these analyses ( $p < 0.031$ ).

In summary, the group-based analyses just presented indicate that there are both similarities and differences across the two groups of gay-sounding speakers in this study. Both the trans men and the gay cis men made greater use of creaky voice quality than the straight cis men. However, the gay cis speakers also had lower F0s than their straight-sounding counterparts, and produced /s/ with a higher center of gravity than either the trans men or the straight cis men. The trans speakers, then, pattern with the gay speakers in some cases (creak), the straight speakers in other cases (center of gravity for /s/), and in other cases still fall somewhere in between the straight and gay cis men (skew for /s/, F0). Together, the analyses in this section point to the diversity that exists among gay-sounding phonetic styles.

#### 4. Discussion

The analysis and literature review that appear in this paper bring up three significant issues that deserve emphasis in this space: evidence for the multiplicity of

gay-sounding phonetic styles, the importance of looking at variation between individual speakers, and the possibility that gay-sounding voices may be adopted through different trajectories of acquisition and driven by different sociocultural processes.

The first of these points is an argument I have returned to throughout this paper: this study supports the conclusion that there is more than one bundle of phonetic characteristics that can be perceived as gay-sounding. I have discussed how different groups of listeners in different perceptual studies of men's sexuality have oriented to different acoustic variables in judging voices as belonging to gay or straight speakers. My own analyses further show that a *single* set of listeners may rate men with different phonetic styles as equally gay-sounding. Although my focus has largely been on the points of contrast between two groups of gay-sounding speakers, there is also significant variation within each of the groups.

In some ways, the idea that more than one linguistic style can be judged as gay-sounding is intuitively obvious, particularly given sociolinguists' attention to the complexities of inter- and intra-speaker variation. Zwicky (1997) and Barrett (1997) were among the first to suggest that we should recognize the diversity of semiotic resources that can be recruited in constructing sexual identities (also Gordon 2008, Jacobs et al. 2000, Podesva et al. 2001). As I have discussed, the strict enforcement of hetero- and gender normativity can lead a huge variety of deviations from an idealized heteronormative masculinity to be relegated to the catch-all stigmatized category, "gay." The notion that different styles can be lumped together perceptually carries with it critical implications for how we go about studying the perception of sexual orientation; yet studies of perceived sexuality and the voice are not often designed to incorporate this possibility. If there is more than one way for a voice to sound gay, we may be limiting ourselves when we focus on uncovering the traits shared by all or most gay-sounding speakers rather than spending equal time on the diversity we find in these individuals' linguistic styles. Sociolinguists like Podesva (2007, 2011), Levon (2006, 2007), and Campbell-Kibler (2007, 2011) have shown some of the great benefits of carefully considering intra-speaker stylistic variation (in the case of Podesva) and the ways social perceptions can be altered by digitally manipulating certain aspects of a speakers' voice (in the cases of Levon and Campbell-Kibler). This is not to say that we ought to entirely reject studies of aggregate patterns across gay- and straight-sounding speakers. The fact that the frequency profile of /s/ has proven significant in so many studies, for instance, is an invaluable finding. However, I posit that an individual-centering approach would greatly bolster our understanding of the variability and boundaries of gay-sounding speech, and thus shed light on the very nature of the linguistic perception of sexual orientation. Though I have employed some of the same analytic approaches taken by many other studies in this area, I hesitate to conclude that vowel dispersion, for instance, plays no role in the perception of sexuality

for these speakers, even if it fails to reach statistical significance when compared across the entire group of speakers. My desire in presenting the analysis above is not to provide conclusive evidence that mean F0, creak, center of gravity for /s/ and spectral skew for /s/ are the exact traits that every listener in this study relied on in making their judgments about speakers' sexual orientations. The idea that a low F0 would make a man's voice sound gayer than a higher F0 seems unlikely, even though the gay-sounding speakers in this study do tend to have a lower fundamental frequency than the straight-sounding men. Instead, my goal is to provide yet another illustration of the complex — and at times even contradictory — results that arise from acoustic analysis of gay- and straight-sounding men's voices. More robust analysis with greater numbers of speakers will surely answer some of our questions; but surveys of large speaker pools also tend to obscure the richness of the variation to be found among individual speakers.

In order to highlight this richness, I turn now to some of the variation that exists among the speakers in this study with respect to creaky voice quality. The number of words each speaker produced with creak, which appeared in Table 4, is reproduced in Table 8 (along with percentage values for reference).

As I have discussed, the gay-sounding men made use of significantly more creaky voice than the straight-sounding men. On the other hand, it is clear that

**Table 8.** Number of words with creaky voice quality, by speaker (reproduced from Table 4)

<i>Group</i>	<i>Speaker</i>	<i>Mean gayness rating</i>	<i>Mean F0</i>	<i>Creaky words (n out of 110)</i>	<i>Creaky words (%)</i>
Gay men	11. Craig	3.93	115 Hz	30	27%
	12. Matthew	3.06	103 Hz	47	43%
	13. Jim	3.05	120 Hz	4	4%
	14. Bob	3.00	85 Hz	83	75%
	15. Tom	2.94	127 Hz	53	48%
Straight men	6. Drew	2.20	109 Hz	16	15%
	7. Kirk	1.95	105 Hz	28	25%
	8. Pete	1.89	156 Hz	0	0%
	9. Fritz	1.81	113 Hz	8	0.7%
	10. Connor	1.73	111 Hz	15	14%
Trans men	1. Phil	3.59	91 Hz	44	40%
	2. Erik	3.07	102 Hz	74	67%
	3. David	2.50	129 Hz	22	20%
	4. John	2.38	123 Hz	30	27%
	5. AJ	2.26	97 Hz	60	55%

some of the gay-sounding speakers use very little creak. Jim, for instance, has a mean gayness rating of 3.05 (out of 5), which is nearly identical to the ratings given to two other gay cis speakers, Matthew (3.06) and Bob (3.00), as well as trans speaker Erik (3.07). Yet Jim has creak in only 4% of the 110 words analyzed, while Matthew produces 43% of these words with creaky voice quality, Bob produces 75% with creaky voice, and Erik produces 67% with creak. Speakers that used very little creaky voice, including Jim, typically produced it only at the ends of intonational phrases. Speakers like Bob, however, used this voice quality consistently throughout the read passage, sometimes even in phrase-initial contexts. Jim's absence of creaky voice does not make him less gay-sounding than Bob — in fact, in many ways Jim sounds like the stereotypical gay-sounding man, complete with dramatic shifts in pitch and a highly expressive reading style. Jim is also one of only two speakers to have a mean skew for /s/ below zero. Bob, by contrast, read the passage less dramatically and less fluidly, sounding mumbled, monotone, and far less gay than he does in his casual speech. However, Bob also has one of the more negative skews for /s/, and a strong California accent that may contribute to his gay-sounding style (see Podesva 2011).<sup>7</sup> If, as Yuasa (2010) argues, creak is a feature gaining traction among young speakers of American English, it may be that older gay-sounding men are less likely to employ this variable than younger speakers. Jim (from the gay group) and David (from the trans group) were the only speakers in their 40s or 50s, and both of them use creak less often than the other members of their groups, who are 32 or younger. Whether variables like age or generation contribute toward the production and/or perception of gay-sounding phonetic styles is a promising topic for further study.

As a final point about individual speaker styles, I want to stress again that the stylistic context in which variables appear is key, as linguistic variables take on meaning not on their own but in relation to one another (Campbell-Kibler 2007, 2011, Eckert 2008, Levon 2006, 2007, Podesva 2011). As an example, we can look to one of our straight cis speakers, Kirk, and see that he produced approximately the same amount of words with creaky voice quality as did John (in the trans group) and Craig (in the gay group), yet these three individuals have quite different gayness ratings. Creaky voice quality in 30 out of 110 words may sound gay when produced by Craig, who has the most negative skew for /s/ of any speaker in this study as well as greater vowel dispersion than any other speaker (and the highest mean gayness rating in the sample at 3.93). But when produced by Kirk, who sounds quite straight (mean rating 1.95) no doubt in part due to his much lower frequency /s/, 28 words with creaky voice may not sound gay at all. John, too, produced 30 words with creaky voice quality, yet fell in between Kirk and Craig when it came to mean gayness rating (2.38). This discussion provides only a starting point for analyzing the speaking styles employed by the individuals I recorded,

and I hope that these comments can spur further conversations about how we can capture the linguistic diversity that lurks just below the surface of analyses like the one I presented in Table 3.

I now close this discussion by revisiting some of the thoughts about the acquisition of gay-sounding phonetic styles that I introduced earlier in this paper. Few, if any, published studies have attempted to gather empirical evidence on the acquisition of sexuality-linked phonetic styles, but several authors have commented on their potential origins. As I mentioned earlier, some authors have emphasized that gay-sounding speech is not simply an imitation of femininity (Gaudio 1994), but rather constitutes a claim on a distinctly gay male identity. Munson (2007) has continued this line of argument, noting that gay-sounding men's voices would probably be more similar to women's voices if such speakers were actually orienting toward norms for women's speech (as the voices of trans women make particularly clear, Munson et al. 2006:226). Rather than aiming to speak "like women," gay-sounding men appear to draw on a selective combination of gendered phonetic variables that index gay identity rather than femininity. From this perspective, exposure to gay-sounding men — or at least their representation in the media, as Gaudio (1994) mentions — may be necessary in order to learn how various linguistic indexes of gender can be combined in the process of indexing gay identity. We might expect, from this perspective, that the process of coming to self-identify as gay, or beginning to participate in gay communities, would be a catalyst in the development of a gay-sounding voice.

I have also discussed how another set of authors have put more emphasis on gendered language socialization during childhood as a potential source of gay-sounding voices (most explicitly articulated by Jacobs et al. 2000, Renn 2002). If the production of gender difference through articulatory practice begins in childhood, surely the acquisition of gendered sociophonetic features like /s/ is part of the story behind gay-sounding sociolinguistic styles.

An emphasis on the relationship between gender normativity and sexuality suggests that gay-sounding voices might be traced back to a time before an individual understands himself to be gay. It also sets up the expectation that some straight men will habitually speak in ways perceived as gay-sounding on the basis of their enactments of masculinity (or, indeed, any number of ostensibly non-sexual factors) rather than their sexuality per se. Drew, who had the highest gayness ratings of all the straight cis men in this study, told me that he has at times been mistaken as gay, which he connected to his self-identification as a nerd who is uninterested in machismo. A speaker's orientation to gendered language socialization may be related to his sexuality, but a speaker need not be gay nor have exposure to men who are gay or have gay-sounding voices in order to acquire this type of gay-sounding voice.

Theories that emphasize gay identity and those that emphasize gender socialization each answer important questions that the other alone cannot address. A fully-developed picture of gay-sounding voices needs to incorporate both sexuality and gender, both identity and socialization, as mutually constitutive forces. More to the point, if there are in fact multiple gay-sounding styles, there may also be multiple routes in the acquisition of a gay-sounding voice. Perhaps some gay-sounding speakers are perceived in this way from childhood or adolescence onward, while others develop a gay-sounding style only after coming out publicly as gay (as Barrett 1997 also suggests). For some speakers, gay identity may be crucial; for others, gender expression could be key. Gender and sexuality may be operationalized separately for analytical purposes, but they are unavoidably linked in the dominant systems of social meaning that permeate contemporary US cultures. Identities based on sexual orientation are gendered identities, meaning that gay and lesbian identities carry with them an expectation of gender transgression, while straightness is associated with gender normativity. This does not mean that gay men are feminine and lesbian women are masculine, but rather that gay and lesbian identities are constructed in relation to ideologies about the connection between gender and sexuality, regardless of whether any given individual fits into or undermines the stereotypes. Identity work, after all, involves tactics of both affiliation and disaffiliation (Bucholtz & Hall 2004, 2005).

Trans men's voices highlight the importance of looking to the intersections between gender and sexuality because of the way trans speakers are able to recontextualize the experiences and linguistic resources they amass living in two gender roles. In the process of constructing male personae that may diverge significantly from hegemonic norms, they bring the low pitch afforded by testosterone together with an array of sociolinguistic styles. In this closing point, I draw on my recent ethnographic research with 15 different trans men in their first year of testosterone therapy, with the understanding that these observations are more about the insights to be gained from studying trans voices rather than a claim about how the particular speakers whose voices I have analyzed in this paper acquired the speaking styles they used as I recorded them. Zimman (2012) deals with these issues in greater depth.

Trans men's discourses about trans identity and masculinity reveal varied and at times ambivalent relationships with the gendered socialization they experienced early in life. Although transgender narratives of coming out prototypically include some reference to discomfort with gender norms introduced in childhood or adolescence, many trans people contest the importance of their childhood experiences with gender (Zimman 2009). It is certainly true that some trans men have long histories of enacting masculinity, linguistically and otherwise, by the time they take steps toward a social transition from female to male. As these individuals'

vocal pitch lowers with testosterone, their voices may come to be indistinguishable from those of heteronormative cis men. Other trans men, however, begin their transitions with more conventionally feminine self-presentations that are conveyed in part through their phonetic styles. Contrary to the expectation that trans people hope to sound as much like gender normative, straight, cis men or women as possible (Zimman 2012: ch. 4), many trans men embrace non-normatively masculine speaking styles. Even the more conventionally masculine trans men who participated in my ethnographic work often talked about feeling like their childhood socialization experiences had a lasting effect on their speech and other aspects of their gender presentation, like gesture. Yet my analysis of trans men's metalinguistic commentary, along with lists of "passing tips"<sup>8</sup> that circulate in online trans communities, shows that trans men generally put more stock in the laryngeal changes brought about by testosterone than any behavioral changes they might self-consciously take on (cf. Kulick 1999). This stance can be explained in part by virtue of discourses within the community that emphasize speaking with an "authentic" voice — so long as testosterone provides a male-sounding pitch range. But it is also important to know that many trans men work to distance themselves from hegemonic masculinity, and instead align themselves with various non-normative masculine identities (Zimman 2012: ch. 6). Perhaps especially in the San Francisco Bay Area, trans men represent a huge range of masculinities, which they might describe with words like *typical*, *masculine*, *fem(me)*, *dandy*, *queer*, *metrosexual*, *feminist*, or *sensitive*. Many trans men embrace their identities as uniquely trans men, creating distinction (Bucholtz & Hall 2004, 2005) between themselves and cis men who might have similar gender presentations, identities, or sexual attractions. Indeed, sexuality plays an important role in trans men's gender identity management, as authors like Vidal-Ortiz (2002) and Rubin (2003) have described, and identification with queer sexualities provides trans men who are only attracted to women a means of distancing themselves from heteronormative manhood (Townsend & Papp 2012). Trans men who position themselves as resisting hegemonic masculinity — and, to be sure, not all do — have that much less incentive to work at masculinizing their voices. A full explication of the ways that trans men understand their voices and deploy the linguistic resources available to them is beyond the scope of this article, but my purpose in summarizing these issues is to draw attention to the ways linguistic habits that may have been acquired through childhood language socialization can be recontextualized later in life as expressions of various non-normative masculinities and sexualities.

## 5. Conclusions

The blends of lived experience, changing vocal anatomy, and self-identified genders that trans men bring to life give us a unique perspective from which to consider the relationship between gender, sexuality, and the voice. In this study, trans men provided the impetus and the opportunity to ask whether groups that are lumped together perceptually as “gay-sounding” might make use of phonetic styles that are significantly different from one another. Focusing on diversity among gay-sounding speakers can help scholars of sexuality and the voice understand the inconsistencies that appear across studies of perceived sexual orientation. Among the speakers in this study, there were significant differences in the phonetic styles of the trans men and the gay cis men, even as listeners perceived the groups as equally gay-sounding. Furthermore, my discussion of individual speakers’ use of creaky voice quality reveals that neither of these groups is internally homogenous. Despite the overall correlation uncovered between creak and perceived sexuality, some of the most gay-sounding speakers in the study made almost no use of creaky phonation. Similarly, I discussed three speakers with near identical mean gayness ratings who made use of creaky voice quality at quite different rates. Taken as a whole, these findings underscore the point that scholars of style have brought to the sociophonetics of sexuality: individual variables do not carry meaning in a way that can be divorced from their stylistic context because it is the combination of variables that work to index stances, personae, and identities. At the same time, some features appear to have more robust indexical links to gay identities than others, as Campbell-Kibler (2011) also argues; /s/ in particular has the distinction of being the subject of metalinguistic commentary as well as a consistently significant factor across the literature. Even so, the stylistic bundles that trans men deploy take on vastly different gendered meanings depending on how their gender is perceived. The production of /s/ with a highly negative spectral skew could be an index of unmarked femininity when produced by a speaker who is perceived to be female, whereas an /s/ with the same frequency profile could be taken as a signifier of gay identity if the speaker is thought to be male.

Looking at variation among gay-sounding speakers reveals one of the linguistic manifestations of hegemonic masculinity, wherein a narrow range of acceptable masculinities is valorized while others are stigmatized through association with femininity or homoeroticism. The range of gay-sounding styles captured in this paper is relatively small, and while my analysis points to the importance of diversity, it certainly does not capture the diversity that actually exists among gay-sounding men. One piece of this discussion that remains unaddressed in my own work and in the literature on the sociophonetics of sexuality more broadly is the relationship between sexuality and other social positionalities such as race, class,

and age (among others). What trans men do, in the context of this study, is shed light on the intersections between gender normativity and sexuality, challenging us to think through the ways that these facets of subjectivity are intertwined with one another. The identity work done by gay-identified men is clearly not the only driving force behind gay-sounding phonetic styles, and the voices of trans men underscore the gendered complexities of sexuality as a cultural construct. If we recognize the potential for numerous phonetic styles to be categorized as gay-sounding, it follows that there might be multiple trajectories through which gay-sounding voices emerge. The work from here on out consists of reimagining sociophonetic research on perceived sexuality in ways that do not lose sight of the diverse masculinities subjugated by hegemonic forces.

## Notes

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1. I use the term *cisgender*, and its shortened form *cis*, in reference to men who are not trans, following the use of this term in trans communities with which I have worked. *Cis* derives from the Latin affix meaning 'on the same side as' — cf. the grammatical categories *translocative* and *cislocative* — so that cisgender individuals are those who identify with the gender assigned to them at birth.

2. There are two potential explanations for trans men's invisibility. On the one hand, members of communities of trans men often point to the dramatic visual and audible effects of testosterone on gender signifiers like beard growth and vocal pitch. On the other hand, it is surely important that there is far less public awareness of trans men's existence; the prototypical trans person remains, in most cases, a trans woman. Serano (2007) argues that a crucial factor that is not often considered in discussions of the visibility gap between trans women and trans men is the degree of scrutiny applied to women's gender presentations; this, according to Serano, leaves trans women particularly vulnerable to visual and auditory inspection and evaluation.

3. There were a few earlier publications on gay men's voices (namely Lerman & Damsté 1969 and the similarly relevant Terango 1966 on male "effeminacy"), though they reproduce the pathologizing discourses about homosexuality characteristic of social scientific research from that time period. Socially-oriented research on gay men's voices re-emerged in the 1990s with

the development language and sexuality studies, or *queer linguistics* (Leap, ed. 1995, Livia & Hall, eds. 1997).

4. Importantly, this gender difference does not hold across all communities. For instance, Stuart-Smith's (2007) study of Glasgow English shows that gender differences in /s/ are pervasive in the speech of middle class Glaswegian adolescents and adults, but that working-class young women produce /s/ similarly to the adult men whose speech she analyzed.
5. The correlation between center of gravity and skew comes closer to significance, but falls short of the 95% confidence level ( $t = 2.043, p = 0.062$ ).
6.  $\alpha$  (i.e. the p value that must be reached for a statistical relationship to be considered statistically significant) can be adjusted by multiplying the number of comparisons by the standard  $\alpha$ . In this case 10 comparisons times 0.05 equals 0.007, so the adjusted  $\alpha$  is 0.007.
7. Notably, Bob cultivates a "partier" persona very similar to the one constructed by the speaker analyzed by Podesva (2011), who varied his use of the California Vowel Shift in concert with phonetic features that index sexuality.
8. *Passing*, a highly controversial term within the trans community, is a descriptor applied to trans people who are perceived as members of their self-identified gender. That is, trans men who are perceived by others as men are said to *pass*.

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## Appendix: The Rainbow Passage

The text read by speakers was Fairbanks' (1960) "Rainbow Passage." The following is the complete text of this passage; the bolded portion is the section of the text used for acoustic and perceptual analysis in this study.

*When the sunlight strikes raindrops in the air, they act as a prism and form a rainbow. The rainbow is a division of white light into many beautiful colors. These take the shape of a long round arch, with its path high above, and its two ends apparently beyond the horizon. There is, according to legend, a boiling pot of gold at one end. People look, but no one ever finds it. When a man looks for something beyond his reach, his friends say he is looking for the pot of gold at the end of the rainbow. Throughout the centuries people have explained the rainbow in various ways. Some have accepted it as a miracle without physical explanation. To the Hebrews it was a token that there would be no more universal floods. The Greeks used to imagine that it was a sign from the gods to foretell war or heavy rain. The Norsemen considered the rainbow as a bridge over which the gods passed from earth to their home in the sky. Others have tried to explain the phenomenon physically. Aristotle thought that the rainbow was caused by reflection of the sun's rays by the*

*rain. Since then physicists have found that it is not reflection, but refraction by the raindrops which causes the rainbows. Many complicated ideas about the rainbow have been formed. The difference in the rainbow depends considerably upon the size of the drops, and the width of the colored band increases as the size of the drops increases. The actual primary rainbow observed is said to be the effect of super-imposition of a number of bows. If the red of the second bow falls upon the green of the first, the result is to give a bow with an abnormally wide yellow band, since red and green light when mixed form yellow. This is a very common type of bow, one showing mainly red and yellow, with little or no green or blue.*

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