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Loose Lips and Silver Tongues, or, Projecting Sexual Orientation Through Speech

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Abstract

The notion that an individual's sexual orientation can be ascertained through distinctive speech patterns abounds in popular culture. This article reviews the small but growing body of literature examining whether sexual orientation is conveyed and perceived through speech. These studies show some individuals speak in a way that conveys their sexual orientation to naïve listeners. Contrary to many popular-culture stereotypes, the phonetic parameters that convey gay, lesbian, or bisexual identities are not whole-sale approximation of opposite sex norms, nor does the perception of sexual orientation through speech appear to involve the simple perception of the sex typicality of a talker's voice. In addition to reviewing these studies, this article discusses their implications for research on language acquisition, language processing, and sociolinguistics.

Introduction

As scholars who study speech and language know, it is often hard to talk to the public about our work. Speech production and perception are so fluent and automatic that people have a difficult time reflecting on their form and content. Not surprisingly, then, it is rare to see stories in the popular media, or to have casual discussions, about speech acoustics, speech perception, or the sound structure of language. One notable exception to this, however, concerns socially conditioned variation in speech. Individuals' perceptions (and, often, misperceptions) about socially conditioned variation in speech are often reflected in the popular media. The topic of this review article is variation in speech that conveys talkers' sexual orientation. Our experience as researchers of the sound structure of language is that it stands in contrast to our other research lines (which encompass, among other things, phonological development and disorders and the phonetic characteristics of Native American languages) in that it almost always engages the interest of our friends outside of academia.

However, these discussions often reveal widespread misconceptions about this phenomenon, as well as a wider misunderstanding about the origins of variation in speech.

The purpose of this article is to dispel these misconceptions through a near-comprehensive review of the literature on this topic. Its structure is as follows. We begin by discussing this phenomenon broadly, and by providing conjectures of why it engages people's interests as strongly as it does. We then review findings of studies on how people convey sexual orientation through speech, and how listeners perceive sexual orientation through speech. We close by discussing the impact of this research on a variety of subfields in linguistics, as well as our view of what future research on this topic should examine.

Before we begin our discussion, let us define its scope and its terms. We can analyze human communication at many levels of representation and function. This is true as well of sexual orientation and speech. We could easily write an article five times the length of this to discuss portrayals of sexual orientation in text, distinctive lexica in sexually transgressive individuals, and conversational pragmatics, among others. There are as many linguistic devices for marking group identity or for stereotyping a group as are linguistic structures. For the sake of brevity, we limit our discussion to the articulatory and auditory characteristics of sounds, words, and utterances. We discuss not only how sexual orientation is articulated through speech, but also how it is perceived, and misperceived, as well. We restrict our discussion further to the phonetics of spoken languages, rather than to signed ones, due to a paucity of research on sociophonetic variation in signed languages. In the interest of brevity, we limit our discussion to the production and perception of sexual orientation – homosexuality, heterosexuality, and bisexuality – rather than to transgendered and trans-sexual people, a decision we return to in the discussion. Throughout the article, we use the term GLB, standing for GAY, LESBIAN, OR BISEXUAL, rather than HOMOSEXUAL and BISEXUAL. We do so because of our strong feeling that the latter terms invoke a 'pathologized' view of sexual orientation that does not jibe with current views that same-sex attraction are part of the normal diversity of sexual behavior (e.g., Bagemihl 1998; Roughgarden 2004). For parallelism, we adopt the term STRAIGHT to describe individuals with opposite attraction. Although on the surface this term may evoke a similar prescriptive view of sexuality, we believe that it is preferable to the term HETEROSEXUAL. Moreover, the term STRAIGHT has gained usage in GLB-friendly organizations, such as the gay–straight alliances that have formed in many secondary schools in the USA.

A final proviso regarding this article concerns the scope of its authors' expertise. We are laboratory phonologists – experts in the cognitive representations of the sound structure of language – with a strong interest in how social knowledge and social expectations affect these representations. We are not experts in language and gender. Hence, this article focuses on

the structure and content of speech styles that convey sexual orientation. Considerably, less attention is given to theoretical perspectives on the association among language, gender, and sexuality. Readers interested in those topics are encouraged to seek out the very comprehensive surveys of that literature by Eckert and McConnell-Ginet (2003) and Cameron and Kulik (2003), and the citations therein.

I Am Curious (Pink)

The ability to communicate symbolically is arguably the defining feature of our species. For a significant proportion of our waking lives, most of us communicate symbolically, either through voice or through manual sign. The very frequency with which we communicate lends itself to automaticity. Imagine if we were to consciously plan every aspect of speech production, from intention to articulation, such a process would be herculean, and would surely limit our ability to communicate while engaging in other complex tasks. Given this automaticity, it not surprising that individuals' ability to introspect about the sound structure of human communication is limited. There are, however, some instances in which people hold very strong stereotypes about the speech of different groups. These stereotypes relate to the social categories that are arguably the most widely discussed in North American culture: ethnicity, social class, gender, and regional geographic affiliation. For example, Preston and Robinson (2006) provide a review of stereotypes that relate to regional dialects, particularly as they relate to dialects' perceived adherence to standard forms in language.

The class of stereotypes discussed in this article relates to one highly salient social category, sexual orientation. An immediate and highly relevant illustration of stereotypes about GLB people's speech comes from portrayals of them in popular media. Gay male characters were often portrayed via stylized, feminine voices. Popular television programs like *Will and Grace* disseminate stereotypes to millions of viewers by presenting two types of gay men: the frivolous, stereotypic Jack and the attractive, subdued professional, Will. These stereotypes are also propagated in popular literature. For example, author David Sedaris recollects how the group of boys with whom he attended speech pathology as a child for an /s/ misarticulation appeared to be a 'Future Homosexuals of America' organization (Sedaris 2001). This is arguably an illustration of perhaps the most widely cited characteristic of GLB speech style, the 'gay lisp'. The notion of the gay lisp is so entrenched in North American culture that the online encyclopedia Wikipedia has an entry describing this purported entity. Wikipedia describes the gay lisp as:

> . . . a stereotypical speech attribute often assigned to gay males. It is often characterized as a slightly high pitch with the 'S'-type sounds being slightly

> slurred and over-emphasized. Several speech features are stereotyped as markers of gay male identity: careful pronunciation, wide pitch range, high and rapidly changing pitch, breathy tone, lengthened fricative sounds, and pronunciation of *t* as *ts* and *d* as *dz*. Some researchers report that North American gay men tend to pronounce sibilants (*s*, *z*, *sh*, and the like) with assibilation – more sibilation, hissing, or stridency. However, other demographic groups also use assibilation and many people speak with lisps. (Wikipedia 2006)

Wikipedia is a user-authored, freely user-edited resource. Its citation in this article is not meant to imply that it is a valid scientific source. In fact, it is mentioned for quite the opposite purpose, to emphasize the way that gay speech styles are represented in the popular culture. The Wikipedia entry characterizes the gay lisp very broadly, using terms that do not have consistent operational definitions in the fields of speech-language pathology, speech science, and phonetics, such as SLURRED and OVER-EMPHASIZED, and at least one construct, PITCH, that is generally used to describe the rate of vibration of the vocal folds for periodic speech sounds, and not the center of spectral energy in voiceless sounds like /s/.

The sources cited above all come from the popular culture. What, if anything, does the sizable scientific literature on the strength and content of stereotypes about GLB people tell us, about sexual orientation and speech? First, many studies show that the population, on average, holds prejudicial views of GLB people. Hudson and Ricketts (1980) developed a standard instrument for measuring homophobia. Using this instrument they concluded that, on average, people in North America can be described as 'low-grade homophobic'. Moreover, an additional 7.2% can be characterized as 'high-grade homophobic'. Haddock, Zanna, and Esses (1993) examined attitudes towards a number of different social groups in the UK. They found an average affective rating of GLB people of 40 on a 100-point scale, where higher values indicated more-positive opinions. According to the labels given with their scale, this score corresponded to a rating of 'slightly unfavorable'. Madon (1997) examined the strength of a number of stereotypes about gay men. She found that stereotypes fell into two categories, those that attributed feminine characteristics to gay men, and those that viewed gay men as rejecting traditionally masculine attributes. Additionally, Boysen, Vogel, Madon, and Wester (2006) showed that many people hold stereotypes that gay men suffer from more mental health problems than straight men.

Clearly, not all people hold the same views about GLB people. A research literature also exists on factors that mediate people's beliefs about GLB people. Haddock et al. (1993) found that participants' ratings of GLB people were predicted by independent measures of their stereotypes about GLB people, their symbolic beliefs about GLB people (i.e., 'the values, customs, and traditions that they believed are blocked or facilitated by typical' GLB people), and a measure of their affective beliefs (i.e., the 'feeling or emotions they experience when they see, meet, or think about

typical' GLB people). Haddock et al. (1993) also found that individuals who held authoritarian views held more negative views about GLB people than those who did not. Herek (1988) showed that women were less likely than men to hold negative beliefs about and attitudes toward GLB people. Whitley (2002) found that variation in individuals' attitudes toward GLB people was statistically associated with a variety of measures of gender identity and self-concept. Kite and Deaux (1986) showed that individuals' attitudes toward GLB people influenced their affective ratings toward them, and their willingness to interact with them in experimental measures of social interaction.

The previous paragraphs show that negative beliefs about GLB people can be substantiated in experimental studies. However, there are very few published experimental studies of listeners' beliefs about the content of GLB SPEECH STYLES despite the fact that these are seen widely in popular media. One exception to this was found in Madon (1997), who showed that one of the strongest stereotypes her participants held about gay men is that they speak in a 'soft voice'. One of the attributes that gay men were seen to REJECT is the propensity to speak in a 'deep voice'. These findings are difficult to interpret, given that the attributes 'deep' and 'soft' may refer to a number of different articulatory and auditory dimensions, including vocal pitch, resonant frequency, voice quality, or vocal intensity.

In addition to providing experimental documentation of stereotypes about sexual orientation and speech, there are theoretically driven reasons for studying this phenomenon. First, there is a growing consensus in the fields of laboratory phonology, psycholinguistics, and sociolinguistics that individuals invoke social expectations and social stereotypes when processing language. Given this, it is important to catalog the range of socially constructed variation that might affect language processing. Moreover, there is evidence, as reviewed below, that GLB speech styles are learned, socially and culturally conventional ways of speaking. Consequently, a detailed understanding of their structure is prerequisite to studies of how and why they are learned by children, adolescents, and adults.

It is with this background that we begin discussing studies of sexual orientation and speech. This discussion is broken down by examining speech production first, followed by studies of perception. We then outline what we believe the contribution of these studies to be to the broader literature on speech and language. We close by speculating on future directions for research in this area.

Production Studies

SPEECH PRODUCTION: A CRASH COURSE

The intense and widespread interest in gay speech styles (indeed, with any speech styles) is matched, unfortunately, by a general lack of understanding

of speech production and speech acoustics. This section briefly describes this process. A key to understanding speech acoustics is the principle that sounds' acoustic characteristics are the combination of two factors: a noise source, and a filter through which this source is passed. For voiced sounds produced with a relatively open vocal tract (such as vowels, and consonants like /m/, /n/, /ŋ/, /r/, /l/, /w/, and /j/), the noise source is the vibrating vocal folds. Vocal-fold vibration contributes two qualities to speech: its perceived pitch and voice quality. Perceived pitch is related (though not identical) to the rate of vibration of the vocal folds. Voice quality is related to the degree to which vocal-fold vibration is perceived as creaky or breathy, which itself is to the consequence of how long the vocal folds stay closed during vibration, and whether they close completely. The vocal-tract filter contributes at least two qualities to the acoustic speech signal. First, the filter is shaped differently for different sounds. For the sound /i/, as in the word *street*, the filter is configured in such a way that the first resonant frequency is very low – often as low as it can be given a vocal tract of a particular size. The second resonant frequency is very high – again, as high as it can possibly be for a vocal tract of a given size. For the vowel /ɔ/, as in the word *straw*, the resonant frequencies are in the opposite relationship: the first is very high, and the second very low. The spacing of resonant frequencies is arguably the primary perceptual cue for many sounds, including vowels. At the same time, however, the shape of the vocal tract filter influences another property of resonance peaks, their overall spacing. All else being equal, resonant frequencies will be higher for people whose vocal tracts are shorter than for those who are longer.

This simple description would suggest that any variation across talkers is merely the consequence of differences in the vocal 'hardware' with which individuals are endowed. Indeed, some of the variation across individuals is due to exactly that. A person with a larger larynx will, on average, produce vocal fold vibration that is lower in frequency, that is, that is lower pitched, than one with a smaller larynx. A person with a shorter vocal tract will produce vowels with higher-frequency vowel resonance peaks than a person whose vocal tract is longer. Given that men have, on average, larger larynges and larger vocal tracts than women, we might conclude that male–female differences in vocal pitch and resonance are due entirely to these anatomical differences. One might then make the conclusion that any group differences – such as differences between GLB people and straight ones – is due to similar factors.

A finer-grained look at speech reveals a situation that is many orders of magnitude more complex than this simple conjecture would suggest. The first level of complexity comes when considering sounds that are not produced with an open vocal tract. Acoustic models of these sounds, including the fricative sounds such as /s/ and /ʃ/, and the stop sounds like /p/, /t/, and /k/, are much more complex than those of vowels. The

complexity of modeling the articulation to acoustics process leads to a reduced ability to determine the inverse, that is, to determine articulation when given an acoustic output.

The second level of complexity comes when considering that many, if not all, of the anatomic and physiologic factors that influence speech production can be countered by active articulatory movements. For example, vocal tracts can be volitionally lengthened or shortened by a variety of maneuvers, including lowering or raising the larynx, and protruding or retracting the lips. A difference in the overall spacing of resonance peaks between two talkers might be due to differences in vocal tract size, or to differences in the use of articulatory movements that lengthen or shorten the vocal tract.

Vocal pitch differences across talkers are subject to a similarly ambiguous interpretation. Pitch can be raised and lowered with great precision – something that talkers do regularly to show listeners how utterances should be interpreted. For example, a low pitch range is used in many North American dialects of English to show that an utterance is being made as a parenthetical comment, not central to the topic being discussed. An overall fundamental frequency difference between the connected discourse of two talkers may reflect one talker's propensity to include parenthetical comments, rather than differences in the size of the vocal folds.

Moreover, there are substantial acoustic differences between languages, dialects, and individual speakers in the production of speech sounds that are ostensibly the 'same', at least at the level of a naïve listener's percept, or even of a skilled listener's phonetic transcription. For example, the sound transcribed as /t/ differs in English and in Swedish in ways that are revealed only through detailed, quantitatively rigorous acoustic and kinematic analyses. The learning of these differences is shown by studies in which it is demonstrated that these cross-language differences are observable early in language development (Buder and Stoel-Gammon 1998).

The ways that this variation is encoded in long-term representations for language is a matter of some debate. One model is presented by Beckman, Munson, and Edwards (forthcoming, see Pierrehumbert 2003 for a related proposal). A schematic of this model is presented in Figure 1. In this framework, representations begin with detailed sensory encodings of the acoustic and kinematic characteristics of speech sounds, as well as detailed sensory encodings of the events to which they were indexed. The speech encodings are parsed into categories. These categories occur at multiple levels of abstraction. For example, the intervals of aperiodic energy at the beginning of the words *street* and *straw* are parsed as members of the category 'word initial consonant' – a category in which they contrast with categories like 'word-medial consonants' and 'word-initial vowel'. The same sound would be parsed into category 'voiceless alveolar fricative' – a category

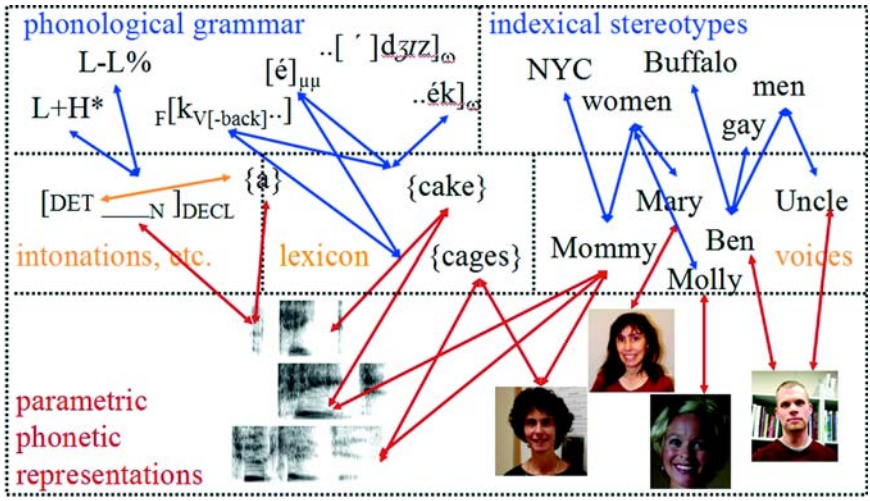

Fig. 1. A schematic picture of the hierarchical, parallel organization speech sounds as they relate to indexical, lexical, and pragmatic knowledge (adapted from Beckman et al. forthcoming).

in which they would contrast with 'voiced alveolar fricative' and 'voiceless alveolar stop', among others. Such categories would themselves be subject to further abstraction, to categories like 'alveolar' and 'word-initial position'.

The parametric indexical encodings would also be subject to abstraction into categories. For example, people's voices might be parsed into categories like 'hyperarticulate', 'tall', 'older', 'local', etc., which themselves would be combined into superordinate indexical categories. Representations in the parametric acoustic and kinematic domains would also be linked to these indexical categories.

These two chains of abstraction share two basic properties. The first is that there are both specific and categorical representations in both domains. Parallel specific and categorical representations are needed to explain a variety of psycholinguistic data with both typical speakers and speakers with atypical speech and language abilities. Second, in both of these domains, people's ability to reflect consciously on their specific knowledge is constrained by their category into which this variation is parsed. There is strong experimental evidence for individuals' ability to perceive, encode, remember, and reuse fine perceptual detail (e.g., Goldinger and Azuma 2004). However, individuals' OVERT knowledge of speech generally reflects the categories and not the fine detail.

MEN AND WOMEN

A starting point for interpreting the findings of studies on sexual orientation and speech is a non-exhaustive review of studies of the differences

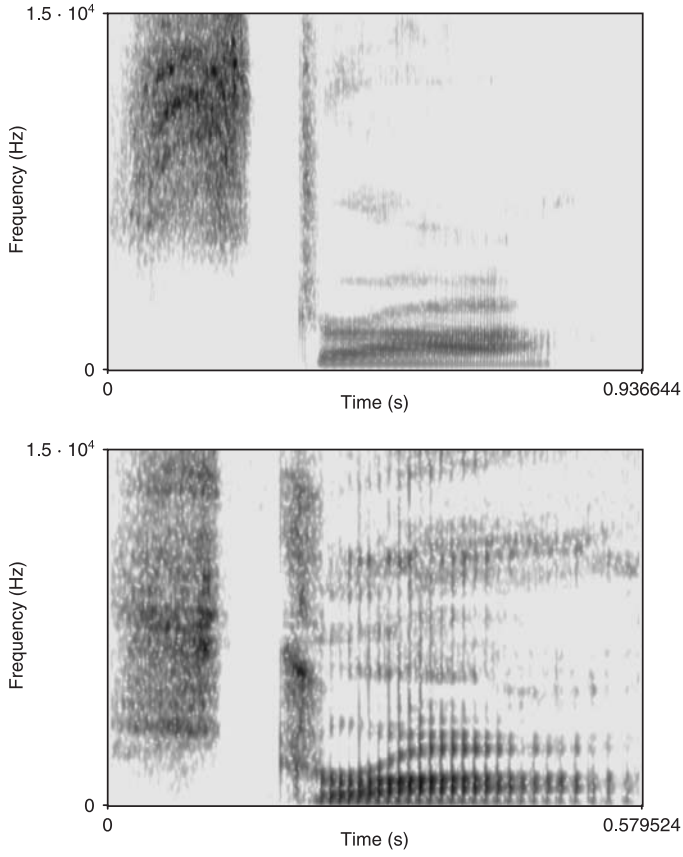

Fig. 2. Spectrograms (top) and voicing-source waveforms (bottom) for the woman's (top) and man's (bottom) productions of the word *street*.

between men's and women's speech. An illustration of how convolved these different sources of variation in speech are comes from a cursory examination of tokens of the words *street* and *straw* produced by a woman and a man, taken from an archival database of words used in perception experiments in the first author's laboratory. Spectrograms for the word *straw* are shown in Figure 2; spectrograms for *street* are in Figure 3. The vocal tract of the woman (whose spectrogram is shown on the top of each figure) is presumably shorter than the man, given her overall smaller stature. Based on this, we might predict that her resonance peaks would be overall higher than they his, and indeed they are, as shown in both Figures 1 and 2. However, the two people's productions of the vowel in the word *straw* differ also in that the man produces a variant of this sound that is perceived to be slightly less round and less back than the woman's, that is, more consistent with descriptions of the ambient Minnesota dialect. The

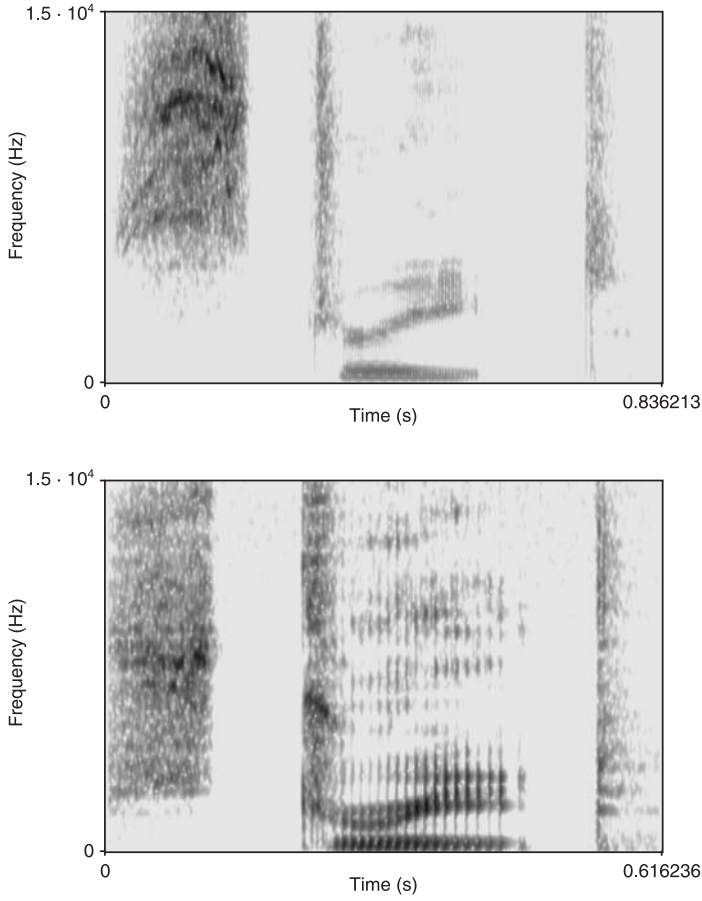

Fig. 3. Spectrograms (top) and voicing-source waveforms (bottom) for the woman's (top) and man's (bottom) productions of the word *straw*.

woman is perceived to produce something closer to the Cardinal vowel /a/. Thus, the resonant frequency differences between the woman and man's productions of the vowel in *straw* differ not only because of the overall vocal tract length differences, but because of other factors such as dialect as well. Similar confounds can be found in this pair when examining sex differences in the initial /s/ of *street* and *straw*. The man's /s/ has a lower frequency cut-off than the woman's, arguably due to his having a larger resonant cavity anterior to the point of constriction than the woman's. However, the man's production of /s/ is such that, when played in isolation, it straddles the first author's perceptual boundary between /s/ and /ʃ/. It arguably reflects this man's coarticulation of /s/ with the /r/ sound that comes later, a phenomenon that has been demonstrated in recent ultrasound studies of speech production (i.e., Baker, Mielke, and Archangeli 2006).

The example in the previous paragraph illustrates many of the complexities of understanding sex differences in speech: differences cannot be reduced to a single factor. Indeed, the fact that men and women's differences cannot be reduced to a single biological factor of 'sex' implies that we should characterize them as GENDER differences instead, as gender differences reflect learned, socially and culturally specific behaviors. The vast literature on this topic has cataloged a number of differences between men and women. Consider, first, the acoustic differences between men and women's speech in simple reading tasks. First, normative studies (e.g., Peterson and Barney 1952; Hillenbrand, Clark, Getty, and Wheeler 1995) consistently find that women have higher fundamental frequencies and higher resonant frequencies than men. Still others have found that women produce speech that is more intelligible than men, particularly in challenging listening situations (Bradlow, Torretta, and Pisoni 1996; Ferguson 2004; Hazan and Markham 2004). This clearer speech appears to be due to a variety of acoustic differences between the sexes. Women produce, on average, vowels that are acoustically more distinct from one another than men. This has been found cross-linguistically for American English, French, and German (Hay, Sato, Coren, Moran, and Diehl, 2006). Women also produce speech with higher average fundamental frequency and greater fundamental frequency variation. Speech-production differences extend to dynamic tasks, as well. Pardo (2006) showed that women are less likely to spontaneously accommodate to others' speech styles in conversational interactions.

Moreover, sex differences appear not to be equivalent across languages. Johnson (2006) shows that sex differences in vowels' resonant frequencies vary widely across languages. van Bezooijen (1995) suggested that Japanese–Dutch cultural differences underlie the different patterns of sex-related fundamental frequency use between these two languages. Munson (2007b) showed that male–female differences in vowel distinctiveness are not uniform across words of varying frequencies of use and phonological neighborhood densities. Phonological neighborhood density is conventionally measured as the number of words that differ from a given word by one phoneme (Pisoni, Nusbaum, Luce, and Slowiaczek, 1985). The more similar a word is to other real words, the harder it is for listeners to perceive (Luce and Pisoni, 1998). Munson found that sex differences in vowel space size were larger for high-frequency and low-density words than for low-frequency and high-density words, an effect that appeared to be due to men's propensity to reduce their vowel spaces disproportionately in the easier-to-perceive high-frequency and low-density words. This suggests that talkers tacitly monitor the effect of gender variants on the perceptibility of words, and that they constrain their use of these variants in cases where it might affect words' intelligibility.

All of the findings in the previous paragraph suggest that at least some sex differences are learned, socially and culturally conventional ways of

speaking. This conjecture begs the question: Why would such styles be learned and used? Here again, a variety of explanations abound. Consider again the finding that women produce more distinct vowels than men. One possible explanation for this phenomenon is that it is one case of the general finding from the sociolinguistics literature that women tend to use more standard variants than men, such as the velar nasal in the English present progressive morpheme *-ing*, perhaps as a mechanism for maintaining power in conversational interactions. If hyperarticulated vowels are seen as a 'standard' variant, then this explanation could apply to that phenomenon as well. Another explanation for this is presented by Simpson (2001), who argued that women's smaller-sized oral cavities predispose them to produce more expanded vowel spaces, as equivalent-sized articulatory movements will lead to more extreme articulations in a smaller vocal tract than in a larger one. Diehl et al. (1996) argued that more expanded vowel spaces (and breather voices) are a means to compensate for the intelligibility decrements that would otherwise result from women's higher fundamental frequencies, given the increased likelihood of there being a mismatch between harmonic frequencies and vocal tract resonances that comes with high fundamental frequency. This conjecture fails to explain sex differences in consonant production, such as women's overall reduced tendency to delete consonants in clusters (Byrd 1994). Namy, Nygaard, and Sauerteig (2002) argued that women's greater tendency to imitate fine phonetic detail might relate to a superior ability to perceive and encode this detail.

As this sampling of studies has shown, the numerous differences between men and women's speech have many potential origins. As we describe below, they have substantial consequences for speech perception as well. Studies of sexual orientation and speech, then, would be remiss to blithely assume that any differences between GLB and straight people can be explained away by a single factor like 'biological differences'.

PEOPLE WHO ARE GLB AND PEOPLE WHO ARE NOT

What, then, has been found in studies comparing GLB to straight people? Gaudio (1994) reports on acoustic and perceptual analyses of a small number of self-identified gay and straight male speakers from the San Francisco Bay Area ($n = 4$ in both groups). A variety of measures of mean fundamental frequency and variability in fundamental frequency were taken from talkers' productions of paragraph readings. No group differences were found in either mean pitch or pitch range, in contrast to the popular culture stereotype that gay men produce higher-pitched voices and more intonational variation. Crist (1997) examined the duration of onset consonants in three gay men producing speech that was judged to be either stereotypic or non-stereotypic. Significant length differences were found in the stereotypically gay male speech relative to the non-stereotypic

speech. Linville (1998) examined acoustic differences between a small sample of Milwaukee, Wisconsin area, self-identified G/B and straight men's speech (n = 5 and 4, respectively). Linville collected readings of a dramatic text. She analyzed a variety of acoustic measures, including measures of the acoustic characteristics of /s/ and measures of the long-term average spectrum. Gay men produced /s/ with higher-frequency spectral peaks and longer durations than straight men; no differences were found in long-term spectra.

One of the most comprehensive studies on sexual orientation and men's speech to date is presented by Smyth, Jacobs, and Rogers (2003). Smyth et al. (2003) report on the development of a database of 25 Toronto area male talkers who vary in the extent to which naïve listeners judge their voice as gay-sounding. Smyth et al. (2003) examined listener ratings for three speech samples: a reading of a scientific text, a reading of a dramatic text, and spontaneous speech. The influence of talkers' self-stated sexual orientation and the type of speech sample on ratings of perceived sexual orientation and perceived masculinity/femininity were examined. Smyth et al. (2003) also examined various measure of vocal pitch, none of which were correlated with ratings of perceived sexual orientation. As in Gaudio (1994), correlations between perceived sexual orientation and perceived masculinity/femininity were highly correlated; however, absolute values differed for the two types of measures. The discrepancy between the two types of measures may have been due to the different phonetic cues that listeners used to judge them. Men with low-pitched voices were rarely rated as sounding feminine, but were sometimes judged to sound gay.

Smyth and colleagues have presented a parallel series of descriptive reports of the acoustic characteristics of the speech samples described in Smyth et al. (2003). These studies have documented many acoustic differences between more and less gay-sounding men, and the relationships between these acoustic measures and listeners' ratings of the talkers. Rogers and Smyth (2001) showed that the more gay-sounding men were more likely to produce vowels closer to the periphery of the vowel space than less gay-sounding men. Smyth and Rogers (2002) report that more gay-sounding men produce stop consonants with longer voice-onset times, longer sibilant fricatives with higher peak frequencies, and more-alveolar variants of /l/ than less gay-sounding men.

Relatively few studies have examined acoustic characteristics of lesbian/bisexual women's speech. Moonwoman-Baird (1997) presented anecdotal evidence suggesting that lesbian women produced conversational speech with more restricted pitch ranges than straight women. More recently, Waksler (2001) examined pitch range in San Francisco Bay Area women's read speech (n = 24), and found no differences between self-identified straight and L/B women.

Two recent sets of studies examined the speech of both GLB and straight women and men using consistent speech materials. Pierrehumbert,

Bent, Munson, Bradlow, and Bailey (2004) examined short samples of read speech from a large group (n = 103) of Chicago area GLB and straight men and women. Pierrehumbert et al. (2004) examined five vowels: /i/, /ɛ/, /æ/, /ɑ/, and /u/. The duration, first-formant frequency and second-formant frequency, of each vowel was measured. Average first- and second-formant frequencies were calculated. Vowel space dispersion was measured, using the technique presented in Bradlow et al. (1996), as the mean euclidian distance from the center of the vowel space. GLB people produced hyperarticulated vowel spaces relative to their same-sex straight peers. For G/B men, this appeared to be due to an overall hyperarticulation of the vowel space. For women, this effect appeared to be driven by the L/B women producing more back variants of /u/ and /ɑ/.

Munson, McDonald, DeBoe, and White (2006) examined 44 talkers, including 11 each lesbian (n = 10) or bisexual (n = 1) women, gay men, straight men, and straight women. Munson et al. (2006) reported that L/B women produced a lower first-formant frequency in the vowel /ɛ/ and a lower second-formant frequency in the vowel /oʊ/ than straight women, and that gay men produced higher first-formant frequency in /æ/ and /ɛ/, marginally higher second-formant frequency in /u/, more negatively spectrally skewed /s/ than straight men.

The studies reviewed thus far all utilized laboratory speech. A recent series of studies by Podesva (2004, 2006a; Podesva, Roberts, and Campbell-Kibler 2002) examined the phonetic characteristics of naturalistic speech. For example, Podesva et al. (2002) examined the acoustic characteristics of radio speech produced by a gay activist lawyer. Podesva (2004, 2006a,b) examined the speech of three gay men in his social circle. Crucially, Podesva (2004, 2006a,b) showed that the rate with which gay men use phonetic markers of gay speech varies with context and conversational partner. This finding provides experimental validation to many people's anecdotal observations that gay styles are used more frequently in some contexts than in others. It is also consistent with the use of other non-mainstream American English variants, such as African–American English (e.g., Seymour, Ashton, and Wheeler 1986; Washington, Craig, and Kushmaul 1998).

What do these differences tell us about the nature of sexual orientation and speech? Perhaps the data are most interpretable when considering what they DO NOT show about this. First, no study provides evidence that GLB speech styles are whole-scale approximations of the speech characteristics of the opposite sex. No study has found an overall shift upward of the resonant frequencies of G/B men's vowels, or a shift downward of the resonance peaks of L/B women's vowels. Moreover, no study has shown group differences in mean fundamental frequency, or variability in this parameter. At least one study, Crist (1997) showed significant differences in one acoustic parameter as a function of the stereotypicality of the speech being analyzed. Crest's study is important because it was

historically the first study to acknowledge that GLB speech styles are not the inevitable consequence of being GLB, and that these styles are best described in reference to the degree of their stereotypicality. In this way, it parallels research from the 1960s to 1970s that demonstrated the finding – now intuitive to nearly every language researcher – that African–American English use is not the inevitable consequence of being Black.

There are a number of possible interpretations of what these data do show. Some of these interpretations follow naturally only when acoustic and perceptual data are considered together, and are thus discussed after perceptual studies have been reviewed. Others, however, can be inferred from the data themselves. Consider, for example, the finding by Munson et al. (2006) that gay men produced a lower, more retracted /Θ/ and /ɛ/ and a more front /u/ than straight men. All three of the variants produced by gay men arguably reflect sound changes in progress, which are less advanced in Minnesota than in other parts of the country (i.e., California). Thus, we might conjecture from this that gay men are participating in this ongoing sound change more readily than straight men. The opposite finding in lesbian women in Pierrehumbert et al. (2004) and Munson et al. (2006) might be interpreted as a resistance to ongoing sound change. Perhaps the most detailed study of the nature of gay speech styles is provided by Podesva's (2006a) study. This study used rigorous ethnographic methods, and thus these inferences were based on detailed analyses of the contexts in which the variants occurred. Podesva conjectured that some gay-speech markers, such as exaggerated releases on final plosive consonants, conveyed the social meaning 'prissiness'. This conjecture is interesting in that it attaches a social meaning to the acoustic findings of Rogers and Smyth (2001) and Munson et al. (2006), who argued that similar acoustic features were used because of their influence on speech clarity. We return to this topic in the discussion.

Perceptual Studies

MEN AND WOMEN

The second set of empirical studies that we review examines how listeners perceive sexual orientation through speech. Again, a starting point for these studies is a review of how listeners perceive sex through speech. The studies involving perception and male–female gender can be divided, broadly speaking, into two groups. One vein of research has explored listener accuracy in identifying male and female voices. It is not surprising that naïve listeners are able to accurately judge the sex of adult male and female voices, even when the acoustic signals from which they make these judgments are short, or have had acoustic information removed (e.g., Lass, Almerino, Jordan, and Walsh, 1980). There are a number of acoustic parameters that might cue sex judgments in adult voices, some of which

are plausibly (though not necessarily) related to the anatomical differences between the sexes (i.e., fundamental frequency and resonant frequencies), and others of which are clearly not (i.e., use of language-specific sociophonetic variants).

A second line of research has investigated how knowledge of the speaker's gender actually affects the percept garnered from the acoustic signal. Strand and Johnson (1996) first illustrated the integration of gender information in the perception of speech sounds with American English sibilants. They used synthetic fricatives along an /s/–/ʃ/ continuum and naturally produced vowel-consonant closures to create stimuli that ranged from *sod* to *shod*, with seven fricative points in between. Listeners judged the tokens as *sod* or *shod*. Men elicited more *sod* responses than females; this is, predictably, because listeners expect to a lower spectral center of gravity for men than women. A second experiment incorporated visual stimuli with the audio tokens. Results show that listeners used the visual information (i.e., the visual gender of the talker) to determine the identity of the acoustic signal.

In a series of follow-up experiments, Johnson, Strand, and D'Imperio (1999) investigated the effects of visual stimuli on the perception of an ambiguous vowel continuum. Continua were constructed from /ʊ/ to /ʌ/ for the words *hood* and *hud* for stereotypic and non-stereotypic sounding male and female voices. These stimuli were presented along with male and female faces. Listeners chose more *hood* responses for female faces than male faces; there were also more *hood* responses when the original voice was female. The more stereotypical sounding female voice elicited more *hood* responses, and the more non-stereotypical sounding male voices received more *hood* responses. These results are intriguing, because the most stereotypical female voice actually had a lower fundamental frequency than the non-stereotypical female voice, suggesting that mere vocal tract normalization from fundamental frequency was not driving the results. Johnson and colleagues then presented two groups of listeners with a voice that had been synthesized to sound ambiguous in gender with the same *hood* to *hud* vowel continuum. The first group of listeners was told that the talker was female and the second group was told the talker was male. Listeners were more likely to label a stimulus as *hood* if they had been told the talker was female. Simply having a gender category in mind was enough to sway the percept of the identity of the vowel.

Strand (2000) provided evidence through a series of experiments that stereotypical sounding voices are processed faster than non-stereotypical sounding voices. A cohort of male and female talkers was recruited whose voices varied in their sex typicality, as it was defined by listeners. A separate group of individuals participated in a series of speech-processing studies, including speeded word recognition tasks. Across these tasks, listeners performed more quickly and more accurately when presented

with the stimuli from stereotypic men and women than non-stereotypic ones. Strand (2000) argued that these data are evidence that individuals' perception benefits from being able to parse talkers quickly into categories like 'man' and 'woman'.

PERCEPTION OF SEXUAL ORIENTATION: BEYOND GAYDAR

How do people perceive sexual orientation through speech? This broad question actually encompasses a number of smaller questions. The first question under this topic is simply one of detection: when given a sample of spoken language and a two-alternative forced choice, can listeners accurately label a talker's sexual orientation? This question presumes that listeners' perception of sexual orientation is categorical. It is logically possible, however, that this variable is perceived continuously. Hence, a second question that can be asked is whether listeners label GLB people as more GLB-sounding than straight peers using a continuous rating scale. The third question is rather distinct from the first two; namely, what do people perceive when they perceive sexual orientation in speech? In some cases, this is clearly transparent, such as the use of conversational topics or lexical items that are associated with the GLB community (i.e., talking about a same-sex domestic partner, a man addressing another man as 'sister'). However, in content-neutral speech, what do listeners listen for? This question can be answered in two ways; first, by examining the acoustic parameters that predict judgments of perceived sexual orientation, and, second, by examining the internal semantic structure of perceived sexual orientation as a social-indexical category. Each of these will be discussed below.

Take the first question: how accurately can individuals gauge a talker's sexual orientation categorically from audio-only speech samples? Relatively few studies have examined this question. Linville (1998) asked listeners to judge the sexual orientation of four self-identified straight talkers, and five self-identified gay talkers, based on reading samples. The overwhelming majority of listeners correctly perceived the sexual orientation of straight talkers; listeners accurately identified self-identified straight talkers as straight 93.5% of the time while only identifying self-identified gay talkers as gay 68.4% of the time. A smaller proportion of listeners correctly identified the sexual orientation of the gay talkers, though identification was at greater-than-chance levels. Carahaly (2000) examined the ability of GLB and straight men and women to identify the sexual orientation of a different group of GLB and straight talkers. The talkers' speech samples comprised conversations with GLB and straight conversational partners on neutral topics (i.e., the weather). Listeners identified the sexual orientation of gay men and of straight men and women when they were played samples of these people talking to gay conversational partners. Overall, Carahaly (2000) found that listeners

identified sexual orientation accurately approximately 70% of the time. GLB listeners were 5.2% more accurate in identifying the sexual orientation of lesbian talkers than straight listeners were. Unfortunately, this study did not utilize the kinds of signal-detection measures that would allow us to assess whether this apparent superiority was due simply to a bias by heterosexual listeners to only guess women's sexual orientation as straight.

Smyth et al. (2003) asked listeners to judge whether talkers were gay-sounding or straight-sounding, rather than to make an inference about their sexual orientation. Their talker sample included 17 self-identified gay men, and eight self-identified straight men. Extrapolating from data in their article, self-identified gay men were significantly more likely to be rated as gay-sounding than self-identified straight men, $\chi^2_{[df = 1,\ n = 2400]} = 4050$, $P < 0.001$. Smyth et al. (2003) are careful to point out that their samples were not chosen randomly, and thus are not intended to reflect the GLB and straight populations more broadly.

Relatively more studies have utilized gradient measures of perceived sexual orientation. Gaudio (1994) examined listener ratings of the connected speech of a small sample of a series of seven-point equally appearing interval scales. Thirteen listeners rated the samples on four scales (*straight~gay*, *effeminate~masculine*, *reserved~emotional*, and *affected~ordinary*). Self-identified gay men were rated as sounding gayer and more effeminate than self-identified straight men for two different texts. Measures of perceived sexual orientation and perceived masculinity/effeminacy were highly correlated. Group differences in the other two perceptual dimensions were not found for both text types. Measures of pitch range and pitch variability were moderately correlated with measures of perceived sexual orientation and perceived masculinity/effeminacy (Pearson's *r* for all comparisons was approximately 0.65). These did not achieve statistical significance, perhaps due to the small sample size. This suggests that one of the cues that listeners use when perceiving sexual orientation is modulation of fundamental frequency. This hypothesis was investigated further by Levon (2006). Using resynthesized stimuli, Levon (2006) showed no relationship between fundamental frequency modulation and listener ratings of sexual orientation.

Smyth et al. (2003) examined ratings of perceived sexual orientation for two types of texts, a dramatic text and a scientific one, and for connected speech. They found significant main effects of talker sexual orientation and passage type on ratings of perceived sexual orientation. Self-identified gay men were rated as more gay-sounding than self-identified straight men. There was an interaction between talker sexual orientation and text type: ratings of self-identified gay men were similar across the three types of speech materials. In contrast, self-identified straight men were rated as more gay-sounding when reading the scientific text than in the other two conditions. This finding suggests that one of the parameters that

listeners use when judging sexual orientation is formality of speech style, as the straight men were rated as more gay-sounding in the more formal reading condition.

Babel and Johnson (2006) further investigated the relationship between gay-sounding speech and formal speech styles using the talkers' readings of the scientific passage from Smyth et al. (2003) in two experiments. In the first experiment, listeners were presented with the entire (approximately 30 seconds) length of the passage from the 25 talkers and were asked to rate the talkers' reading ability. Responses were logged as a continuum on an equal-interval five-point scale, where the end-points represented *a good reader* and *a bad reader*. The analysis revealed a main effect of perceived sexual orientation on perceived reading fluency: gay-sounding men were rated as more fluent readers than straight-sounding men. This suggests that judgments of sexual orientation are not necessarily judgments of sexual orientation, but may reflect listener judgments (like reading ability) that listeners stereotype as a trait associated with sexual orientation. The second experiment asked listeners to determine whether the talker was reading TO someone at the moment of recording. The relationship between judgments of listener presence and judgments of sexual orientation was not significant, but there was a significant relationship between perceived listener presence and perceived reading ability. Regression analysis found that listener judgments in both experiments were cued primarily by the resonant frequencies of the vowel /a/. Babel and Johnson (2006) conclude that judgments of social categories, like sexual orientation, are not isolated judgments, but are related to broader social stereotypes that encompass a variety of traits.

Munson et al. (2006) examined the gradient nature of perceived sexual orientation by having 40 listeners rate 44 talkers' sexual orientation on a five-point equally appearing interval scale. The 44 talkers were described earlier, and included equal numbers of GLB and straight men and women. Listeners' average ratings for the 22 straight talkers differed significantly from their average ratings for the 22 GLB talkers. For ratings of men, this was mediated by the phonemic content of the stimuli that were being rated. Larger mean differences were found for stimuli containing non-high front vowels than for those containing non-low back vowels. When averaged across the 40 listeners, ratings for individual talkers showed some overlap between GLB and straight people. For example, the two men who were tied with the most-gay average ratings included one self-identified straight man, and one self-identified gay man. Regression analyses showed that ratings of men's and women's sexual orientation were associated with vowels' average second-formant frequency, and, to a lesser extent, first-formant frequency. Higher resonant frequencies were associated with judgments of more-GLB speech in men, and more-straight speech in women. In addition, the spectral skewness of /s/ predicted judgments of men's sexual orientation, where less negatively skewed /s/ was associated

with judgments of more-straight speech. Overall vowel space expansion was associated with judgments of women's sexual orientation, with larger sized vowel spaces being associated with more-straight speech.

Munson et al. (2006) conducted two additional experiments. In one, listeners were presented with data from the same set of talkers and were asked to guess the talkers' relative height on a five-point scale. In the other, listeners' were presented with pairs of words in a +10 dB signal-to-noise ratio, and were asked to choose who they believed to be the clearer talker. Ratings of perceived height and perceived clarity were strongly correlated with measures of perceived sexual orientation for both men and women. Men who were rated to sound tall and less clear were also rated to sound straight; women who were rated to sound tall and less clear were also rated to sound GLB. Munson et al. (2006) conjectured that GLB speech styles might be exaggerated clear-speech styles (in gay men) or articulatory maneuvers to give the illusion of a smaller sized vocal tract (in straight women). Munson (2007a) examined ratings of masculinity and femininity for the same group of talkers. These were made by listeners who did not participate in the original experiment, and who were unaware that they were making ratings for individuals whose sexual orientation had been rated previously. Correlations between average masculinity/femininity and perceived sexual orientation ratings were statistically significant for both men and women, although the correlation was much higher for women ($r = 0.94$) than for men ($r = 0.58$). Regression analyses showed that independent sets of acoustic measures predicted the two rating types. Average fundamental frequency predicted masculinity/femininity ratings, but not perceived sexual orientation ratings. This finding is consistent with observations made by Rogers and Smyth (2003), who found that, while mean fundamental frequency and fundamental frequency variability did not predict gayness ratings, gayness ratings were strongly correlated with independently made judgments of perceived intonational variability. That is, the voices that one group rated to sound gay were rated by an independent group of listeners to sound as if they had greater fundamental frequency modulation. Listeners were more likely to falsely judge a voice to be produced with greater fundamental frequency modulation if that voice had been judged by an independent group to sound gay.

Munson, Jefferson, and McDonald (2006) examined whether perceived sexual orientation affected listeners' phonetic identification, using a task modeled on Strand and Johnson (1996). Munson, Jefferson, and McDonald (2006) created a series of 44 *sack–shack* and 44 *sip–ship* continua, made by splicing a nine-step synthetic /s/–/ʃ/ continuum with 44 natural productions of /æk/ from the word *sack* and /ɪp/ from the word *ship*, produced by the 44 talkers in Munson et al. (2006). As expected, listeners identified more tokens of *sack* and *sip* when listening to men's voices than women's. There was a gradient relationship between fricative identification and

perceived sexual orientation of women's voices: women who had been rated as lesbian-sounding by participants in Munson et al. (2006) elicited more /s/-initial word judgments than women who were rated as straight-sounding. Regression analyses suggested that this effect was not wholly attributable to perceived vocal tract length differences between the groups.

What do these results tell us about sexual orientation and speech? Once again, the results are notable both for what they do and do not tell us. First, just as in production studies, the findings of perception studies show that, while there are group level differences between GLB and straight people in the gay soundness of their voices, overlap does exist. This finding provides a serious challenge to a simple model in which speech differences were the inevitable consequence of sexual orientation. Second, findings suggest that measures of perceived sexual orientation are not simply related to their perception of male- or female-typical speech features. For example, there is a clear consensus across studies that average fundamental frequency, and variation in fundamental frequency, is not related to actual or perceived sexual orientation. This is notable principally because it runs contrary to popular culture conceptions of gay and lesbian speech styles. Interestingly, there is a growing consensus that fundamental frequency is related to masculinity and femininity judgments, perhaps showing that fundamental frequency differentiates between the parameters of perceived sexual orientation and perceived masculinity/femininity.

The findings also provide a window into the nature of these speech styles. The finding that perceived sexual orientation is correlated with measures of other perceptual parameters, including speech clarity and perceived height, suggest that GLB and straight speech styles might comprise combinations of maneuvers to give the illusion of differences in stature, as well as clear speech transforms.

Theoretical Contributions and Future Directions

The studies reviewed thus far suggest that sexual orientation can be conveyed and perceived through distinctive pronunciation of sounds and words. This research area is in its infancy, and, like many infants, is currently experiencing a growth spurt. This section outlines our view of what the most important areas of emerging research on this topic are.

QUEER PLANET

The first question that we believe to be absolutely essential to answer is: how general are these patterns across languages, cultures, and dialects? The importance of this question is driven home by the findings reviewed earlier that there are substantial cross-language differences in the extent to which men and women's speech differs. We might expect, then, a similar

amount of cross-language variation in differences between GLB and straight people. There is a true dearth of research on variation and consistency in GLB speech styles. Even considering the research on North American speech styles, these investigations have been limited geographically. The only studies published in peer-reviewed journals that have included more than 20 participants have examined groups from Toronto and Minneapolis/St. Paul, Minnesota – two areas where very similar sounding dialects are spoken. Moreover, only one study that we could find examined gender typicality in male speech in another language, by comparing a single less masculine sounding man to a more masculine sounding man (Guzik 2006). This language, German, is typologically similar to English. Not surprisingly, the parameters that were found to be similar to those reported for English.

This question is truly important for at least three reasons. First, languages differ in the sounds that they use to code lexical contrasts. This limits the range of variation that can occur in these languages. For example, Manuel (1990) showed that vowel-to-vowel coarticulation is constrained by languages' inventory of vowels. If this restriction extends to social categories, then we might expect cross-linguistic differences in the parameters that are free to convey sexual orientation. We conjecture that speakers of languages that do not use voice quality to code lexical contrasts, such as English, are presumably freer to use this parameter to convey social-indexical categories like sexual orientation than languages like Hindi, which do use it for lexical contrasts. We further conjecture that speakers of a language like French, which has a lexical contrast among words containing the high front unround /i/, high front round /y/, and high back round /u/, would presumably be less free to front /u/ to convey social categories than languages like English, as this would potentially compromise the lexical contrast between words with a high front round vowel like /ty/ (*tu*, the second-person singular pronoun) and words with a high back round vowel like /tu/ (*tout*, the word for 'all') in French. A finding that cross-language differences in sexual orientation and speech are not subject to such constraints might bolster, indirectly, arguments that these speech variants are due to anatomic or physiologic differences.

A second reason why cross-linguistic studies are important is that cultures differ both in the overall level of tolerance to sexual diversity within and across genders. In fact, cultures even differ in terms of what types of sexual identities are acknowledged and given labels. For example, an impressive amount of linguistic anthropology research has been conducted on the *hijras* of India, a community of individuals who are often considered a third gender of Indian society (Hall and O'Donovan 1996; Hall 2002). The study of gendered speech as linguistic patterns specific to a sex was, perhaps, first pioneered by Sapir (1929) in his study of the speech particular to men and women in the now extinct American Indian language Yana. Sapir (1929) describes Yana male speech to have

less reduction than female speech. The variation is often more subtle and fine grained in nature, but, as we can see, this varies considerably across cultures. Most languages, however, are not so overt or comfortable in their gendered varieties of speech. It is more typical for the female or effeminate way of speaking to be held in a negative regard, even when gender equality is assumed to be the standard between men and women in a given culture (Lakoff 1975). Reaching a cross-cultural and cross-linguistic understanding of the construction of gender and sexual identity is crucial in our greater understanding of humans and our communication systems generally.

Finally, sexual orientation and speech patterns merit cross-linguistic and cross-cultural examinations, similar to the way that gender differences have been studied cross-culturally and cross-linguistically. The manner in which speech patterns of GLB communities differ within a given culture may be mediated by variables known to interact with other social variants, such as socioeconomic status and regional variants. They may also interact with the degree of stigma or acceptance associated with diverse sexualities in different cultures.

ACQUISITION AND CHANGE

The nascent discipline of laboratory phonology is concerned with using experimental methods to examine the nature of cognitive representations for languages' sound structure (Pierrehumbert, Beckman, and Ladd 2001). As such, it is concerned intimately with how sounds are acquired, processed in real time, and represented in long-term memory.

Throughout this article, we have argued that speech styles conveying sexual orientation are learned. This prompts the question: when are these patterns learned in development, and why? First, consider studies of children's acquisition of sex-typical ways of speaking, such as Sachs, Lieberman, and Erickson (1973) and Perry, Ohde, and Ashmead (2001). Sachs et al. (1973) found that listeners were able to judge the gender of children 4–14 years of age with single-sentence stimuli with 81% accuracy. The children used in the investigation were matched for height and weight across genders. Sachs et al. (1973) suggest that boys (and, as they age, men) manipulate their resonance peaks from a young age to present themselves as more masculine. Perry et al. (2001) conducted a similar investigation using boys and girls 4, 8, 12, and 16 years old. In this study, listeners were able to accurately judge the gender of all age groups at better-than-chance levels using single word stimuli. Perry et al. (2001) report that these judgments were chiefly based on the position of first-formant frequency and second-formant frequency. Gender differences observed in prepubescent children do not appear to be secondary to physiological differences between boys and girls, and, therefore, must be acquired. Given that children do learn sex-specific ways of speaking

early in life, it is possible that children also acquire GLB speech styles early in life.

One possibility is that the learning trajectory relates to individuals' development of a sexual identity, that is, as either GLB or straight. In this scenario, GLB styles would only emerge after a person has developed a GLB identity, an event that typically occurs after adolescence in North American cultures (Ramefedi, Resnick, Blum, and Harris 1992). Another possibility is that these represent attention to and emulation of selected models in the ambient language for the duration of language acquisition. It is difficult to imagine a logistically feasible study examining these two possibilities. This would require a large-sample, long-term longitudinal study of sex typicality in speech in which both direct and indirect measures of individuals' sexual identity are taken. Such a study would require human and capital resources that are beyond what such a study might warrant.

Although population-based research on the development of sexual orientation and speech is likely not feasible, it is possible to examine this question indirectly. Crocker and Munson (2006) studied this by examining the speech of children who were likely to adopt a GLB identity as adults, in comparison to children who were not likely to do so. Previous research has suggested that children who are given the label gender identity disorder (GID) are more likely to adopt a GLB identity as adults than children without GID. Children labeled as GID display a variety of gender non-conforming behaviors relative to their peers without GID, including the sex composition of their peer group, the propensity to select opposite sex-typed toys and games, and, in some cases, overt gender dysphoria. Crocker and Munson (2006) found that naïve listeners rated content-neutral speech samples of 5- to 13-year-old boys with GID as sounding less prototypical than age-matched peers without GID. Group differences were larger for older children (mean age = 10 years) than younger children (mean age = 7 years). In multiple regression analyses of the single-word stimuli, listener ratings were most strongly predicted by the second-formant frequency of vowels (children with higher second-formant frequencies were rated as less prototypically male sounding). Smaller but significant predictive relationships were found between both F3 frequency and /s/ spectral peak and gender typicality ratings.

Work on the acoustic characteristics of the speech of children labeled as GID is an important first step in this endeavor, but it is limited to modeling at best the development of this speech style in only the subset of adults who demonstrated identifiably gender non-conforming behavior in childhood. An important caveat in this research is that there is no reason to presume *a priori* that GLB speech styles are what is being acquired when a child speaks in a manner that is less typical than his/her biological sex would suggest. For example, consider Crocker and Munson's (2006) finding that the second-resonant frequency of /u/ differed

between children with and without GID, and that normalized second-formant frequencies had a gradient relationship with average sex typicality measures. Just as in the data presented by Munson et al. (2006), this may reflect the selective engagement in an ongoing sound change in children labeled as GID. We return to the question of acquisition in the general discussion.

Research on the acquisition of GID styles has strong implications for research in the subdiscipline of language socialization. Language socialization is the study of how individuals are socialized into and through language to become competent speakers of language and competent members of society. This discipline is concerned with the process of acquisition of linguistic and cultural norms and patterns by learners. Traditionally, language socialization research is ethnographic and longitudinal in nature, so as to accurately record the natural processes and routines of socialization (Garrett and Baquedano-López 1992). In particular, this research should revisit traditional sociolinguistic methods of examining the structure of individuals' social networks, to determine the extent to which individuals' speech reflects the speech of the peer communities with whom they interact the most. Such studies would by necessity need to use the less-structured elicitation methods that are characteristic of sociolinguistic research.

The ethnographic and longitudinal methods of language socialization have the potential to contribute tremendously to our knowledge about the acquisition of GLB speech patterns. By studying speech development longitudinally and ethnographically, we are able to witness the human interactions that supply the input for speech acquisition at the moment we witness any speech output from the learner. Language acquisition in general is mediated by an individual's exposure to the language (Docherty and Foulkes 2000). Methodological insights from language socialization can provide the means for which we learn about the acquisition of GLB and other social variants in speech.

SOCIOPHONETIC VARIATION AND REAL-TIME PROCESSING

We argue that future research should examine in detail the role of overt and tacit stereotypes about sexual orientation on listeners' speech perception. A number of studies have shown that even low-level aspects of speech perception are affected by social knowledge and social biases (e.g., Niedzielski 1999; Strand 2000; Hay, Warren, and Drager 2006). The findings in Munson, Jefferson, and McDonald (2006) suggest that listeners' phoneme identification may be influenced by talkers' perceived sexual orientation. Clearly, however, more research in this area is needed. In particular, future research should examine whether these influences are mediated by listeners' overt and tacit beliefs about sexual orientation and speech. Such a finding would provide powerful evidence that social stereotypes mediate ongoing language processing, a claim that Strand (2000) and Hay, Warren et al. (2006) have advanced.

LINGUISTIC VARIATION AND SOCIAL MEANING: NATURE AND MEASUREMENT

Variationist sociolinguistics is interested in how speakers index social categories through variation in language forms, including variation in speech. In many early works, sex was treated as a relatively immutable binary variable. In recent years, variationists have rethought the construct of sex, and have opted for the more nuanced concept of gender as a variable in their investigations (see Discussion in Milroy and Gordon, 2003), where gender differs from biological sex in that it is seen as a learned, socially constructed, culturally specific variable. However, gender is still often relegated to being a categorical distinction rather than a continuous variable. The production and perception studies reviewed above illustrate that, in terms of sexual orientation, GLB- and straight-sounding cannot be considered as a binary set of phonetic practices, and is better seen as a continuum.

Moreover, this research has shown that an individual's sexual preference does not have inevitable consequences for ways of speaking. Straight-sounding speech and straight lifestyles are not necessarily causally linked. A self-identifying GLB individual may not pattern with GLB-sounding talkers in phonetic experiments while a self-identifying straight individual may, in fact, pattern with GLB-sounding talkers. These facts caution against wholesale assumption of that social categories are truly categories, as is assumed by traditional variationist analyses.

Indeed, the research on general male–female differences is ripe for methodological retooling to address this problem. Conceptualizing gender in straights as occurring on a binary male–female scale ignores the wealth of control that individuals have over their use of different sociophonetic variants to convey different social meanings. Furthermore, it does not capture how listeners perceive gender in speech. Strand (2000) used multidimensional scaling analyses to examine how listeners organize male and female talkers perceptually. Multidimensional scaling (MDS) refers to a broad class of computational algorithms that attempt to uncover the underlying structure of matrices of similarity measurements across a set of items. In MDS studies of voice similarity, listeners might provide similarity or dissimilarity ratings of pairs of talkers. MDS then fits these data to *n*-dimensional solutions, which represent the similarities among the talkers. Strand's (2000) MDS analysis showed that male and female talkers clearly occupy opposite ends of the listeners' perceptual spaces, but there was as much perceptual distance WITHIN each category as there was across categories. Moreover, the MDS analyses that best fit the data were not unidimensional. Strand's (2000) results suggest that not only is a binary system a fail to capture listeners' conception of gender, and that a unidimensional continuum fails to capture listeners' percepts of gender as well.

Multidimensional scaling analyses are one means of addressing this shortcoming of traditional research on discrete social categories. This

method has as its weakness the inherent ambiguity in interpreting multidimensional scaling solutions. These solutions cannot tell what these dimensions represent. However, research that has utilized multivalued rating scales to ascertain gradience in social categories is not without its weaknesses. At a psychometric level, research in the perception of talker characteristics has shown more often than not that equally appearing interval scales are psychometrically inferior to other types of rating scales, such as visual analog scales, or direct magnitude estimates. Research on social categories should be no less invested in establishing the psychometric validity of the scales that are used to assess social categories.

Last, and perhaps most challenging, is the need to develop standard methods for assessing the social meaning of different speech variants. Currently, the two principle methods for assessing social meaning are ethnographic analyses, and laboratory studies using rating scales. Ethnographic analyses have the benefit of involving intensive analyses of socially situated language corpora; hence, conclusions about social meanings from these data are based on a substantial corpus of data, and reflect the meanings that members of the language community ascribe to linguistic variants. The size of the corpora and the time associated with making them, however, are also their weakness, in that it is not realistic to conduct these analyses with large cohorts of individuals. Moreover, the meanings that emerge from such analyses all reflect principally the overt beliefs of the community, and do not tap the TACIT linguistic meanings that members of a community might hold. There is no clear solution to this problem. Clearly, innovative research methods are needed to capture both the authenticity offered by ethnographic methods, while still being time effective enough to sample the behavior of large cohorts of talkers and listeners.

STYLE SHIFTING: WHEN, WHY, AND HOW?

A central endeavor in the field of sociolinguistics is to document when individuals shift among different modes of communicating, and developing models to predict these shifts. Intuitively, it seems likely that individuals would use speech styles that convey sexual orientation more in some contexts than in others. One illustration of style shifting within GLB talkers is Podesva's (2006a) ethnographic study of phonetic variation in three gay men. Podesva (2006a) showed that one man's use of one gay-speech marker, the uses of raising pitch in declarative utterances, was more frequent in conversational interactions with gay peers than in professional interactions. Such a finding jibes strongly with many people's observation that GLB speech characteristics appear to be more salient in groups than individuals. However, the focus in early studies on GLB speech styles has been primarily in validating the existence of these styles, at the expense of research on socially situated communication. This field is ripe for further studies on the contexts of variation.

More generally, however, this research should dovetail with other studies of variation to uncover the more general cognitive, perceptual, and motoric skills that support individuals' ability to communicate variably. Such research has the potential to uncover why there is variation across individuals in their use of any variable speech style, be it gay speech, or other social indexical varieties. A clue to this comes from a study by Munson and Baylis (2007). Munson and Baylis (2007) found that children's ability to convey gender in speech is proportional to their broader phonological and lexical development, albeit weakly so. That is, once effects of chronological age have been accounted for, boys with larger-sized vocabularies and better overall perceptual abilities appear to meet more closely cultural expectations for how someone of their biological sex is expected to sound than boys with smaller-sized vocabularies and poorer speech perception abilities. This interesting finding suggests that the ability to learn one aspect of social variation, gender, is related to their broader cognitive–linguistic abilities. This finding sets the stage for a systematic examination of the interaction between variation in style usage and variation in language abilities across a broader population. Indeed, we may find that variation in the extent to which individuals can 'turn on' or 'turn off' their speech style is proportional to their broader cognitive–linguistic acumen.

Conclusion

This article reviewed research on sexual orientation and speech. We have presented evidence that information about a talker's sexual orientation is transmitted through the acoustic signal, in the production of both consonants and vowels. Studies show that listeners can use this information to identify talkers' sexual orientation, and that it may affect other aspects of speech processing. This research has also illustrated that GLB speech variants are not imitations of the speech patterns of the opposite sex, but are likely to be learned, culturally specific ways of speaking, much like other aspects of sociolinguistic variation. We have shown that the results of this line of research have significant implications for diverse fields including phonology, sociolinguistics, and language acquisition.

Throughout the article, we have threaded implicitly the argument that GLB speech variants are part of normal variation in speech production, much in the same way that dialectal variation is part of normal variation in language, and sound change is part of the normal variation in language use across generations of speakers. We bring this up explicitly in the conclusion to contrast it with a possible alternative view of this phenomenon. One might imagine an argument about GLB speech styles that would begin with the very correct observation GLB people are subject to endemic discrimination, including, quite often, threats of violence. Given this, one might argue, it would be unlikely that speech styles coding this identity would be acquired actively, as they would subject the person to

discrimination and violence than a more stealth individual would not suffer. Therefore, such an argument would claim, such styles are unlikely to be acquired actively, as they would be disadvantageous to the person's overall communication. Such an argument might further claim that GLB speech styles must be somehow intrinsically linked to whatever it is that causes same-sex attraction in these people. From here, this line of argumentation might posit that this causal factor is something genetic or otherwise immutable.

The work that we have reviewed in this article suggests a very plausible alternative scenario. We, like many others, argue that speech styles are like other linguistic meanings, in that they are constellations of primitives. In this way, they are parallel to semantic features like [animate], [domestic], and [feline], or pragmatic features like [given] and [new]. Such a view predicts that GLB styles might be acquired not as an entire constellation of features, but by acquiring individual elements of this style, in the interest of conveying the individual social meanings associated with those elements. Indeed, the features that are acquired may themselves have POSITIVE social meanings and POSITIVE communicative value. The more expanded vowel spaces documented by Rogers and Smyth (2001) and Pierrehumbert et al. (2004) might lead to more intelligible speech in the presence of background noise, in addition to conveying, as Podesva (2004) argued, a social meaning like 'prissiness'. Moreover, prissiness itself might convey both negative social meanings (a perception of snobbery) and positive ones (a perception of perfectionism and expertise). In this view, listeners' overt percepts of GLB speech styles as 'less masculine' or 'less feminine' may reflect more the blinding nature of categorization than the actual composition of these speech styles. That is, superordinate categories like 'masculine' and 'feminine' limit individuals' ability to introspect overtly about the internal structure of these categories, in a manner similar to how the categories /s/ and /ʃ/ limit listeners' percepts of variation in the center frequency of an interval of aperiodic noise. Such a conjecture requires a research agenda with the level of rigor and comprehensiveness that we have argued for in the latter part of this article, as this presumption can only be validated if we can measure the structure of social categories with the same level of precision and detail with which we can measure the structure of categories that convey lexical meaning.

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Short Biography

Benjamin Munson is an Associate Professor in the Department of Speech-Language-Hearing Sciences at the University of Minnesota. He teaches courses in phonetics, laboratory phonology, atypical speech and language, and phonological development and disorders. His research examines two broad themes. The first of these concerns the development of lexical and phonological knowledge in typically developing children, and in children with speech and language impairments. This research (done largely in collaboration with Mary Beckman and Jan Edwards) has shown that speech perception, social-indexical knowledge, phonological knowledge, and word learning interact reciprocally during development, sometimes in surprising ways. His second line of research examines sexual orientation and speech. Munson received his BA in linguistics from State University of New York at Buffalo, attended the graduate program in linguistics at University of California, Los Angeles, and received MA and PhD degrees from the Department of Speech and Hearing Science at Ohio State University.

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