Speaking To Sound Gay In Thai: Acoustic Correlates Of Performed Sexual Orientation In Thai Media

Siyu Liang

1. Introduction. A growing body of research has demonstrated that listeners extract socially identifiable information, such as gender and sexual orientation, from a speaker's voice (Gaudio 1994; Pierrehumbert et al. 2004; Zimman 2013). Despite early assumptions that sexual orientation could be inferred primarily from mean fundamental frequency (f_0), subsequent studies have highlighted the multifaceted nature of "gay speech" and "lesbian speech," which appear to involve complex interactions among pitch, formants, and voice quality (Munson et al. 2006; Suire et al. 2020; Barbuio & Paulino 2021). Indeed, while some findings conform to popular stereotypes of higher pitch or greater pitch variability among gay men and lower pitch or narrower pitch range among lesbian women (Gaudio 1994; Zwicky 1997; Van Borsel et al. 2013), other work reports contrasting or null results, suggesting that no single acoustic dimension reliably indexes sexual orientation across speakers or contexts (Rendall et al. 2008; Holmes et al. 2024). In line with research by Vaughn (2019), who demonstrates that listeners' expectations about talker identity can modulate the weighting of individual phonetic cues, our understanding of gay vs. straight speech cannot be pinned on single metrics like pitch or breathiness alone. Listeners dynamically integrate multiple cues with knowledge about possible speaker identities, highlighting the complexity of interaction between orientation and phonetic cues.

Voice quality, encompassing parameters such as jitter, shimmer, and spectral tilt, has recently garnered particular attention in the investigation of sexual orientation indexing. Several studies have argued that in addition to traditional measures of pitch, non-modal phonation types (e.g., breathy or creaky voice) can also function as salient cues to gendered and sexual identities (Podesva 2007; Becker et al. 2022). Evidence from North American English suggests that certain forms of creaky voice are aligned with "straight" presentations in some contexts, whereas breathiness can be perceived as "gay-sounding," although patterns vary considerably across individuals and speech events (Munson & Babel 2019; Zimman 2013). These complexities underscore the need for systematically examining how voice quality operates in different languages and cultural settings, thereby illuminating the broader mechanisms by which speakers index sexual orientation.

Against this backdrop, the present study aims to advance the discussion of how multiple phonetic correlates, including f_0, formants, and voice quality, could variably index sexual orientation in Thai media performances. Focusing on two Thai male actors portraying gay and straight characters in television series, we examine whether they consistently manipulate these pharyngeal settings to display sexuality on screen. In particular, we assess how different roles are associated with shifts in pitch level and range, vowel formants, and the voice-quality measurements (Gordon & Ladefoged 2001; Boersma 2007). Crucially, our data come from extended, scripted dialogues rather than isolated word lists, allowing us to capture how speakers enact these features in natural-sounding media contexts. Although acting is inherently performative, such performances can illuminate how linguistic features become recognizable signs of sexual orientation within specific pragmatic and cultural frameworks.

2. Literature review. An increasing number of studies has investigated how sexual orientation is represented in multiple acoustic dimensions of speech, including fundamental frequency (f_0), pitch range and variability, formant frequencies (F1-F4), and voice quality measurements such as jitter, shimmer, and harmonics-to-noise ratio (HNR). While a large portion of the existing literature focuses on so-called "gay speech" among men, studies of lesbian speech, though fewer, likewise offer insights into parallel or contrasting patterns (Gaudio 1994; Munson et al. 2006; Barbuio & Paulino 2021). Empirical findings vary considerably: some researchers report higher pitch and greater pitch variability among gay men alongside lower pitch or narrower ranges among lesbian women, whereas others find no significant orientation-linked differences in these parameters (Rendall et al. 2008; Holmes et al. 2024). Similar inconsistencies emerge in studies of formants and voice quality, with some identifying clear orientation-based correlations and others observing largely overlapping acoustic profiles (Pierrehumbert et al. 2004; Suire et al. 2020). In the sections that follow, we synthesize this body of work in each acoustic domain, highlighting both convergent trends and contradictory findings. We then discuss how methodological decisions such as data type, sampling, and analytical approaches, as well as broader cultural and linguistic factors could shape speakers' use and listeners' perception of these acoustic cues in indexing sexual orientation.

2.1. FUNDAMENTAL FREQUENCY & SEXUAL ORIENTATION. One prominent line of inquiry investigates whether gay men speak with a higher mean fundamental frequency (f_0) compared to heterosexual men and lesbian women use a lower f_0 relative to their heterosexual counterparts, a simplistic expectation that stems from the broader stereotypes (Suire et al. 2020). Empirical findings, however, are mixed. Early foundational work by Gaudio (1994) analyzed speech samples from gay and straight men, finding little evidence to suggest that mean f_0 alone accounted for listeners' ability to correctly identify speakers as gay or straight. Similarly, Rendall et al. (2008) reported no significant difference in the average pitch used by homosexual vs. heterosexual speakers, challenging the assumption that homosexual men necessarily speak at a higher pitch. Munson et al. (2006), in a study of 44 men and 44 women, likewise found no significant overall effect of sexual orientation on mean pitch.

On the other hand, some smaller-scale studies have reported results that could partially support a mean f_0 difference. Barbuio & Paulino (2021), examining Portuguese speakers, noted a modest but consistent increase in average pitch among gay men (139.6 Hz) compared to heterosexual men (124.2 Hz). However, the authors did not conduct formal statistical tests, and the sample size was limited to seven participants per group, making generalizations difficult. Conversely, an analysis of radio-debate speech by Podesva et al. (2002) found that the heterosexual speaker used an even higher mean pitch than his openly gay debate partner, effectively reporting a reverse of the commonly expected pattern of higher-pitched "gay speech."

Although investigations of pitch and sexual orientation have traditionally centered on men, a few studies address how mean f_0 might differ between lesbian and heterosexual women. Early small-scale work by Moonwomon-Baird (1997) suggested that heterosexual women had higher average pitch and a larger pitch range than lesbian women, although no formal statistical tests were conducted and the sample was limited to two speakers per group. By contrast, Waksler (2001) found no significant difference in pitch range or variability between 12 heterosexual and 12 lesbian women when they explained a film plot in their own words. Adding to the mixed picture, Van Borsel et al. (2013) reported that lesbian women in her sample used a lower mean pitch than heterosexual women. However, as with research on men, these findings come from small or methodologically varied datasets, underscoring the caution needed in generalizing about orientation-linked pitch patterns in women's speech.

Finally, studies of transgender men undergoing testosterone therapy add another layer of complexity to the relationship between sexual orientation and pitch. Zimman (2018) demonstrates that while hormonal treatment can substantially lower mean f_0, perceptions of speakers' sexual orientation do not necessarily change in tandem, underscoring that mean pitch alone is not a straightforward indicator of orientation.

Overall, the limited and at times contradictory evidence indicates that mean f_0 does not serve as a reliable indicator of sexual orientation. Differences in speech tasks, sample sizes, and analytic methods likely contribute to the disparate results, and broader stylistic repertoires beyond mean pitch must be considered when examining how speakers project and listeners perceive sexual orientation.

2.2. PITCH RANGE & SEXUAL ORIENTATION. Beyond the absolute level of pitch, many researchers focus on the pitch range and its variability. A key stereotype, especially in North American contexts, holds that gay men employ a more "dynamic" intonation (i.e., larger pitch swings), while lesbian women may exhibit more restricted pitch range (Gaudio 1994; Zwicky 1997).

Similar to mean f_0, the findings are inconclusive. Gaudio (1994) observed that although listeners accurately identified most gay and straight speakers, pitch range measurements only weakly correlated with perceptions of orientation. Moonwomon-Baird (1997), studying the conversations of lesbian and heterosexual women, reported that the lesbian group displayed a lower pitch range, although the analysis did not involve statistical tests and relied on just two speakers per group.

Some more recent work reported results that are in line with the stereotype of greater pitch variability in gay men. Suire et al. (2020) identified higher pitch modulation in gay men's voices, while Barbuio & Paulino (2021) labeled a "roller coaster intonation" for their gay male speakers: an observed 43% higher pitch variability relative to heterosexual men. However, Holmes et al. (2024) reached a different conclusion, finding that gay men in their sample had a narrower pitch range, illustrating once again the possibly contextual nature of these effects. In sum, the evidence does not confirm a universal pattern of either extreme pitch variability or the other direction among homosexual speakers, highlighting that intonation strategies likely depend on situational, cultural, and individual factors.

2.3. VOWEL QUALITY & SEXUAL ORIENTATION. A longstanding hypothesis is that speakers may hyperarticulate the vowels, with particular emphasis on the so-called "point vowels" such as /i, u, a/, in order to index identities (Eckert 2008; Podesva 2011; Henton 1995). The point vowels occupy the corners of the vowel space and thus show especially large differences when expanded (e.g., a higher or fronter /i/, a more open /a/, a fronter /u/), whereas mid vowels like /e/ and /o/ are presumed to remain stable with no space to render them more different. If that were true, it could explain how some speakers could convey "gayness" by expanding only the high or low extremes of vowel height and backness, without modifying all vowels in the inventory equally.

Empirical findings, however, paint a more nuanced picture. For instance, Pierrehumbert et al. (2004) examined five English vowels (/i/, /e/, /æ/, /ɑ/, /u/) in over 100 speakers of various sexual orientations. While they did find that men identifying as gay/bisexual (G/B) had more expanded vowel spaces overall compared to heterosexual men, significant difference is only found in /ɑ, i, æ/, but not /u, eɪ/. Similarly, Munson et al. (2006), analyzing eight vowels from read speech of English, reported significant differences between gay and straight men only in the low-front vowels (a lower /æ/ and /ɛ/). In women, Munson et al. (2006) found differences primarily in mid or back vowels (/e/, /oʊ/), again suggesting that mid vowels can sometimes diverge among speakers of different sexual orientations.

Further complexity emerges in cross-linguistic research. In a study of Italian and German male speakers (both heterosexual and gay), Sulpizio et al. (2015) found that gay sounding speech is associated with higher F2 in certain mid vowels. For instance, Italian speakers who were perceived as gay tended to produce /a/ and /e/ with more fronting (higher F2), while German speakers showed similar F2 increases for /eː/, /ɛ/, and /ɪ/. Although Italian gay speakers did exhibit some vowel expansion, it was not restricted solely to /a, i, u/. Overall, Sulpizio et al. (2015) concluded that listeners in both languages draw on subtle formant differences to categorize sexual orientation, although the exact vowels involved, and the direction of their shifts, differ from one language and speaker to another.

Collectively, these findings show that different groups of gay/bisexual speakers seem to realize formant shifts in specific vowels, rather than uniformly pushing the corner vowels such as /i/, /a/, /u/ outward, or a one-directional, global shift. Instead, each study reports relatively selective deviations, suggesting that individuals tailor only certain vowels for social or stylistic effect. While "point" vowels may often be salient cues, mid vowels /e/ and /o/ can also become targets of variation.

2.4. VOICE QUALITY & SEXUAL ORIENTATION. Another area of investigation concerns voice quality, encompassing measurements such as jitter (frequency perturbation), shimmer (amplitude perturbation), harmonics-to-noise ratio (HNR), and spectral tilt. These parameters collectively shape how "creaky" or "breathy" the voice sounds, traits often associated with indexical identities such as gender and sexual orientation (Klatt & Klatt 1990; Becker et al. 2022; Podesva 2007).

Although fewer studies focus specifically on these aspects of speech, some have noted sexual orientation-linked differences. (Munson et al. 2006) tested spectral tilt but did not find significant differences between heterosexual and homosexual participants. By contrast, Suire et al. (2020) observed that gay men had less breathiness (measured as lower HNR) than heterosexual men. For lesbian speakers, even fewer data are available. Holmes et al. (2024) found that the speech of homosexual women have higher jitter, interpreted as a creakier voice quality than heterosexual women. As with pitch, it appears that voice quality differences are not monolithic indicators of orientation but emerge in nuanced, speaker-specific ways. However, small-sample case studies (e.g., Podesva et al. (2002)) pointed out that gay speakers could emphasize certain speech features or employ less "flamboyant" voice quality for strategic identity management. From a methodological point of view, the results caution against studies that use averages across vowels or across stretches of speech, which could miss the linguistic and social marking that tends to target specific components and temporal aspects.

2.5. LANDSCAPE OF SEXUAL ORIENTATION CORRELATES. Across the acoustic features examined, an overarching theme is variability, both in how different studies define and measure these variables and in the contexts in which speech samples are gathered. While certain findings align with popular stereotypes (e.g., somewhat higher pitch variability among some groups of gay men, or subtle vowel formant shifts suggesting hyperarticulation), the overall empirical results are far from unanimous. Measures such as mean fundamental frequency (f_0), pitch range, formant frequencies, and voice quality factors each reveal complex interactions among sociolinguistic context, individual speaking style, regional accent, and gendered norms. Recent work in sociophonetics underscores that listeners constantly balance acoustic detail with social knowledge (Vaughn 2019), suggesting that orientation-linked cues may also be reweighted in real time depending on the listeners assumptions about the speaker.

Early research on sexual orientation and speech frequently relied on small sample sizes, limited statistical testing, or scripted reading tasks or word lists (e.g., Linville (1998); Rendall et al. (2008); Munson et al. (2006); Sulpizio et al. (2015); Suire et al. (2020); Barbuio & Paulino (2021)). Such approaches can yield artificial speech styles; for instance, Smyth et al. (2003) demonstrated that "formal" reading passages sometimes made heterosexual men sound more "gay," indicating that task design itself can influence vocal outcomes. More recent investigations, such as Holmes et al. (2024), have addressed these limitations by using larger samples, more fine-grained categories of orientation, and natural conversation instead of purely scripted materials.

Participant grouping also varies widely. Most studies compare gay vs. straight individuals without separately analyzing bisexual participants, while a few, such as Pierrehumbert et al. (2004) and Munson et al. (2006), explicitly incorporate bisexual speakers (either as a distinct category or merged with gay participants). By contrast, Holmes et al. (2024) assesses sexual orientation on a continuum.

Table 3 provides an overview of major studies that explored the link between sexual orientation and various speech properties (e.g., pitch, formant frequencies, jitter, spectral tilt, etc.).

2.6. VOICE QUALITY TYPES AND FUNCTIONS. Among the acoustic correlates discussed above, voice quality is both less extensively studied and more complex. Given that this study employs multiple voice quality measurements, we provide a detailed review of its characteristics in this section.

Voice quality refers broadly to the distinct phonatory characteristics produced by the configuration and vibration of the vocal folds, as filtered through the supralaryngeal vocal tract. In standard models of speech production, phonation itself arises when air pressure from the lungs forces the vocal folds into vibration, creating a quasi-periodic wave. Changes in vocal fold tension, thickness, and medial compression lead to perceptually salient differences in how the voice "sounds," often conceptualized as breathy, modal, or creaky voice, among others. These categories map onto distinct laryngeal settings: breathy voice involves weak adductive tension and incomplete glottal closure, modal voice aligns with a balanced configuration that maximizes quasi-periodic vibration, and creaky voice involves increased vocal fold compression and a lower rate of vibration, often with highly irregular pitch periods (Laver 1980; Gick et al. 2012; Zemlin 1998; Ladefoged & Johnson 2014)

Researchers have documented a wide range of additional phonation types, including tense, lax, stiff, slack, harsh (or pressed), and falsetto, each corresponding to particular muscular adjustments of the larynx (Edmondson & Esling 2006; Ladefoged & Maddieson 1996). While many languages primarily use modal voicing, others incorporate breathiness or creak in phonemic contrasts or in more localized ways, such as marking prosodic boundaries (Redi & Shattuck-Hufnagel 2001). Voice quality can thus bear a variety of linguistic and sociolinguistic functions: certain Southeast Asian languages, such as Hmong, have contrastive registers that mix tonal and phonatory cues (Esposito 2012) and some English dialects use creak or breathiness as an index of gender, affect, or social identity (Podesva 2007; Munson & Babel 2019).

Although the general physiological basis of non-modal phonation is shared across speakers, cross-linguistic variability arises from divergent uses of the laryngeal muscles and from differences in how communities interpret or exploit these phonatory options. Creaky voice can index finality in one language and specific lexical contrasts in another (Gordon & Ladefoged 2001), while breathy phonation can signal feminine affect or function as part of a register system, depending on the cultural or linguistic context (Kuang 2013). In tonal languages such as Thai, pitch interacts closely with voice quality, because both are rooted in the vocal folds' vibration patterns. Related research therefore must disentangle lexical tone from other laryngeal settings to accurately understand how speakers harness phonation for social or linguistic meaning, which will be discussed more in detail in the next subsection.

2.7. VOICE QUALITY MEASUREMENTS. A central methodological concern is how voice quality is measured in empirical studies. The field has converged on several primary strategies. Imaging techniques, including laryngoscopy and high-speed videoendoscopy, provide direct visual evidence of glottal configurations but are technologically expensive and invasive (Zemlin 1998). Electroglottography (EGG) captures vocal fold contact patterns by passing a small electrical current across the larynx and measuring resistance changes; EGG metrics such as closed quotient have been used to determine phonation contrasts in languages that employ breathy or creaky vowels phonemically (DiCanio 2009; Esposito 2012). Acoustic measurements, however, remain the most widely used in sociophonetics, largely because they only require high-quality audio recordings and are less intrusive for participants (Boersma 2007; Shue et al. 2009).

Within acoustic analysis, jitter (period-to-period frequency perturbation) and shimmer (period-to-period amplitude perturbation) are often used to capture the aperiodicity associated with non-modal phonation, with both breathy and creaky voices typically exhibiting *elevated* jitter and shimmer values (Kreiman & Gerratt 2005). However, these measures may not map perfectly onto listeners perceptual judgments of breathiness or creak. Harmonics-to-noise ratio (HNR) tracks how much harmonic structure the vocal folds generate relative to noise in the signal and often decreases in both breathy and creaky voice. Subharmonic-to-harmonic ratio (SHR) can further identify multiple pulsing in more irregular creaky segments (Sun 2002), while cepstral peak prominence (CPP) is another indicator of periodicity, with breathiness or harsh glottalization tending to reduce the cepstral peak (Hillenbrand et al. 1994; Blankenship 2002).

One of the most prevalent indices of voice quality in sociophonetics is the spectral tilt measure H1-H2 (also referred to as $H1^*$-$H2^*$ if formant-corrected), which quantifies how quickly energy decays across harmonics (Chai & Garellek 2022). In breathy voice, slow glottal closure yields stronger low-frequency harmonics and a pronounced drop-off at higher frequencies, whereas tighter closure in creaky voice flattens the spectral slope (Gordon & Ladefoged 2001; Keating et al. 2023). Modal voice characteristically occupies an intermediate state between these extremes. Because H1-H2 responds sensitively to subtle differences in vocal fold contact and airflow, it has proven valuable for cross-linguistic comparisons of voice quality as well as for sociophonetic studies that link vocal style with identity categories (Podesva et al. 2002; Graham 2013).

2.8. LANGUAGE AND CULTURE EFFECTS. Cross-linguistic research highlights that phonetic correlates could also be shaped by cultural and language factors. In her comparative study of Dutch and Japanese speakers, van Bezooijen (1995) observed that Japanese women tend to employ a higher pitch, while Dutch women exhibit less extreme pitch differences. Graham (2013) similarly emphasized that pitch use is culturally and linguistically mediated. Thus, the act of "sounding masculine" or "sounding gay" is not merely about acoustic parameters in isolation, but also a reflection of broader cultural ideologies about gender and vocal behavior.

When investigating language effects on sexual orientation, an additional layer of complexity arises in tonal languages such as Thai. Because pitch simultaneously encodes lexical contrasts and social meaning, one must carefully disentangle the lexical aspects of pitch from other prosodic or voice, quality features that may be used to index identity (Kuang 2013; Munson & Babel 2019). The limited body of Thai sociophonetic research on sexuality underscores the need for such a nuanced approach. For instance, Osatananda & Gadavanij (2019) showed that Thai listeners can reliably rate voices along a "gay-straight" continuum, suggesting that speakers deploy certain phonetic cues, potentially including voice quality, to project sexual orientation. However, the specific acoustic correlates of these perceptions remain unclear. By examining H1-H2 spectral tilt in the voices of Thai actors portraying gay and straight characters, the present study aims to address this gap and to clarify the extent to which laryngeal settings can be harnessed to perform sexuality in Thai media.

Beyond sexual orientation and gender expression, other factors such as speakers' age, ethnicity, also play a role in shaping voice quality (Awan & Mueller 1996; Bahmanbiglu et al. 2017; Ng et al. 2012). Bilingualism research further highlights the influence of the language being spoken on phonatory patterns. For example, Bruyninckx et al. (1994) found that Catalan-Spanish bilingual speakers exhibited greater voice-quality variation between their two languages than within a single language variety, while studies of Cantonese-English bilinguals have similarly reported differences in spectral and pitch parameters depending on which language was in use (Yiu et al. 2008; Ng et al. 2012). However, Altenberg & Ferrand (2006) did not detect significant f_0 differences in their Cantonese-English sample, underscoring that the language effects on voice quality are not always straightforward. Such inconsistencies may reflect confounding variables, including ethnicity, physiological differences, or the degree of bilingual proficiency. Thus, it remains an open question whether and how much switching languages, or performing in different linguistic contexts, systematically alters a speaker's phonation.

The interplay of language specific features and cultural values is therefore crucial to understanding how voice quality is deployed as a social resource. Keating et al. (2023) stress that languages differ in their typical pitch ranges and phonatory settings, making voice quality "one of the many ways in which languages can sound different from one another" (p. 351). In tonal languages like Thai, these differences can be especially salient because voice quality could operate alongside lexical tone to convey meaning. Thus, the present study not only contributes to the broader discussion of cross-linguistic phonation types, but also aims to discuss how Thai speakers may use voice quality as part of a culturally specific performative tool to index sexuality.

2.9. THAI. Central Thai (usually referred to as Thai), belonging to the Tai-Kadai language family, is the primary language of Thailand, spoken by approximately 50 million people (Tingsabadh & Abramson 1993; Thepboriruk 2009). Thai is conventionally described as lacking a contrastive phonation system (e.g., no breathy-modal or creaky-modal vowel distinctions), yet it presents a rich phonological structure that provides fertile ground for studying how voice quality may interact with other phonetic parameters, especially tone and glottal consonants.

Thai features 21 contrastive consonant phonemes. There are nine vowels, each with a length contrast (short vs. long), yielding 18 monophthongal vowels in addition to 3 diphthongs (Tingsabadh & Abramson 1993). Perhaps the most prominent feature of Thai phonology is its five-tone system, which includes three level tones (high, mid, low) and two contour or "dynamic" tones (falling, rising). While Thai is generally described as lacking a register-like system (i.e., no two-way breathy-modal or creaky-modal contrast), a common area feature (Lau-Preechathammarach 2022), research in other tonal languages shows that voice quality often co-varies with certain pitch targets (Keating et al. 2023). For instance, creakiness tends to occur allophonically on lower-pitched tones in languages such as Hmong, Mandarin, and Miao. However, the interaction between Thai's tone and voice quality has not been studied in detail. For Thai, the prevailing view is still that its five lexical tones remain primarily defined by pitch.

A further complication for exploring Thai lies in its co-articulatory nasalization, specifically in the environment following /h/ or /ʔ/ (Matisoff 1975; Johnson et al. 2019). Studies note that low and mid-low vowels (/ɛ, ɔ, a/) produced in stressed syllables exhibit perceptible nasalization when immediately following a glottal consonant (Cooke & others 1989). This pattern may reflect a convergence of phonatory and aerodynamic processes, sometimes dubbed "rhinoglottophilia" (Matisoff 1975), where partially open glottal settings facilitate or are misperceived as nasality. Blevins & Garrett (1992) and Carignan (2017) have similarly linked lower degrees of glottal constriction with increased velopharyngeal coupling, suggesting that once glottal airflow is high or closure is incomplete, co-articulatory or perceptual mechanisms can favor nasal resonance.

Interestingly, researchers have observed variation in the degree of this nasalization: vowels following /h/ tend to sound more nasal than those following /ʔ/, and among the low vowels themselves, /a/ is often described as more nasalized than /ɛ/ or /ɔ/ (Matisoff 1975; Cooke & others 1989). The phenomenon also appears to be dialect-sensitive, with some Northeastern Thai varieties showing more extensive vowel nasalization than the standard Central Thai under investigation (ibid). While previous accounts provide qualitative and impressionistic data, systematic acoustic evidence, especially with regard to how this "breathy-nasal" configuration interacts with pitch or spectral measures, remains sparse.

3. Hypothesis. The aforementioned studies suggest that gay speakers may modify multiple acoustic parameters, including pitch and phonation types, in systematic ways. In particular, several studies have found that gay men use higher overall pitch or a greater pitch range (Gaudio 1994; Suire et al. 2020), though other work highlights variability depending on context and individual speakers (Rendall et al. 2008). Meanwhile, research on European Portuguese has reported minimal but consistent increases in mean f_0 and pitch variability for gay men compared to heterosexual men (Barbuio & Paulino 2021), suggesting that pitch can serve as a salient cue for indexing gay identity.

Beyond pitch, a number of works have noted more frequent or more extreme non-modal phonation (e.g., breathiness) among some groups of gay men (Podesva 2007; Zimman 2013). Along similar lines, other studies have observed lower harmonics-to-noise ratio (HNR) and higher spectral tilt (H1-H2), both of which are associated with breathier voice quality (Suire et al. 2020). Drawing on these findings, we anticipate that when Thai male actors portray gay characters, they will systematically adopt a higher-pitched and breathier voice compared to their portrayals of straight characters.

A methodological consideration arises in this study due to the tonal nature of Thai. In tonal languages, pitch carries not only paralinguistic or sociolinguistic meaning but also fundamental lexical contrasts. As a result, controlling for pitch range can be especially complex, since any differences in pitch span might reflect tonal distinctions rather than stylistic adjustments for character portrayal. For this reason, we focus our analysis on *mean pitch* (mean f_0) rather than pitch range, acknowledging that pitch range could also be an important resource for conveying gay identity but is beyond the scope of this data set.

Consequently, we formulate the following hypotheses for the two Thai actors playing gay versus straight roles in our study:

- H1: There is an effect of performed sexual orientation on pitch. Mean f_0 will be higher when the actors portray gay characters than when they portray straight characters.
- H2: There is an effect of performed sexual orientation on voice quality. Jitter and shimmer will be lower, whereas HNR and spectral tilt will be higher for gay-role speech relative to straight-role speech, indicating a breathier voice quality.

4. Method.

4.1. Data collection. The speech of two Thai male actors, Petch Paopetch Charoensook (Petch) and Ter Ratthanant Janyajirawong (Ter), was used in this study. In real life, Petch is a heterosexual male, whereas Ter is a gay male; both are native speakers of Central Thai. The actors portrayed both gay and straight characters in televised Thai dramas.

Approximately 1 minute of speech was selected for each actor from *Diary of Tootsies* (2016), where both played gay roles, and *Social Syndrome* (2018), where both played straight roles. These samples were extracted from scenes where no overlapping speech by other characters was present. Speech data containing audible background music, laughter, or environmental noise were also excluded. For all experiment settings, the stereo audio was downmixed to a single mono channel at 44.1 kHz, 16-bit.

4.2. Segmentation and annotation. All recorded utterances were imported into Praat (Boersma 2007) for annotation and segmentation. TextGrid files were created to mark each speaker turn, label word boundaries, and annotate vowel segments. Only content words in the Middle tone at non-reducing prosodic positions were selected for analysis. All items are open syllables to avoid potential voice-quality effects from checked tones in closed syllables (Perkins 2011). In addition, any vowels around glottal consonants (/h/ and /ʔ/) were discarded to prevent Thai nasalization (Johnson et al. 2019; Cooke & others 1989) and other voice-quality confounds. For all the valid words, the vowel was first segmented at the onset and offset points by visually inspecting the waveform and spectrogram, taking into account voicing boundaries. Specifically, the vowel onset was marked at the point where clear periodic voicing and formant structure began following the release of a preceding consonant, while the offset was marked at the point where periodic voicing ended or transitioned into the following consonant closure.

Following these criteria, a total of 105 tokens were retained: 19 from Petch's Gay role, 30 from Petch's Straight role, 39 from Ter's Gay role, and 17 from Ter's Straight role. Table 1 summarizes these final token counts by speaker and role.

4.3. Acoustic measurement. Vowel-internal measurements were obtained using Parselmouth, the Python interface to Praat (Jadoul et al. 2018), through automated scripts. Based on the marked vowel onset and offset, the vowel midpoint (50% of the total duration) was automatically calculated for each interval in order to avoid transitional effects from adjacent segments. The fundamental frequency (f_0) was then extracted at this midpoint over a 30 ms window, and formant frequencies (F_1 and F_2) were determined via LPC analysis with a maximum formant setting

Table 1. Number of tokens by speaker and role.

Speaker	Role	Tokens
Petch	Gay	19
Petch	Straight	30
Ter	Gay	39
Ter	Straight	17

of 6000 Hz. This slightly elevated maximum formant value was chosen to account for possible exaggeration in performed speech, especially given the actors' roles. In addition, several voice-quality parameters were measured, including jitter, shimmer, harmonics-to-noise ratio (HNR), and the first two harmonics H1 and H2 for spectral tilt. The bandwidths for the first two formants were also taken for subsequent correction for filter effects. Tokens displaying outlier formant values exceeding three standard deviations from the speaker's mean were flagged for manual inspection; if a tracking error was detected, the formant boundary was adjusted or the token was discarded.

4.4. DATA PREPROCESSING AND ANALYSIS. To account for the vowel effect on harmonic amplitudes, H1-H2 values were corrected following the approach described by Iseli et al. (2007). Specifically, for each harmonic (e.g., H1 at f_0, H2 at $2f_0$), the same speaker's measured formant frequencies (F_1 and F_2) and bandwidths (B_1 and B_2) were used to compute a correction factor. This factor removes resonance-induced boosts in harmonic magnitudes around the formants by subtracting the formant filter's contribution in dB from each measured harmonic.

After obtaining the corrected spectral tilt measurement H1*-H2*, the fundamental frequency (f_0) and the voice-quality measures (jitter, shimmer, HNR, and H1*-H2*) were then normalized using Lobanov's method (z-score normalization), which re-centers each speaker's values at zero and expresses them in standard deviation units relative to that speaker's mean (Adank et al. 2004). This approach helps to control for inter-speaker differences in anatomy and overall voice characteristics, ensuring that any observed effects are not simply due to differing vocal tract lengths or baseline voice quality differences between Petch and Ter.

The effects of speaker and role on the normalized acoustic correlates (f_0, jitter, shimmer, HNR, and H1*-H2*) were evaluated using linear mixed-effects models via the `statsmodels` library in Python. In each model, the acoustic measurements were the dependent variables, whereas *role* and *speaker* were the fixed effects, with *speaker* as a random intercept to accommodate repeated measures from the same speaker. This approach enables us to study the effect of *role* on each acoustic measure while accounting for baseline differences of each *speaker*.

5. Results. Table 2 summarizes the results of the mixed-effects models for each acoustic measure, with *speaker* (Ter vs. Petch) and *role* (Gay vs. Straight) as fixed effects and a random intercept for *speaker*. Boxplots are provided in Section 8.2 of Supplementary materials. Overall, the results report systematic differences with regards to role, while speaker identity effect is not significant once role is accounted for.

5.1. SPEAKER EFFECT. Across the five dependent variables (f_0, jitter, shimmer, HNR, and H1*-H2*), the coefficient for *speaker[T]* consistently fails to reach significance (all $p \geq 0.80$). This result suggests that Petch and Ter do not differ in their overall baseline values for these normalized measures. In other words, once role is controlled for, there is no robust evidence of speaker-specific effects on pitch or voice quality in our dataset.

5.2. ROLE EFFECT. By contrast, the fixed effect of *role[Straight]* emerges as significant in all five models, thereby rejecting the *NULL* (no difference between gay- and straight-role speech). Specifically, straight-role speech exhibits lower pitch ($\beta = -1.008, p < 0.001$), higher jitter ($\beta = 0.676, p < 0.001$), higher shimmer ($\beta = 0.618, p = 0.002$), lower HNR ($\beta = -0.871, p < 0.001$), and a lower H1*-H2* value ($\beta = -0.872, p < 0.001$) relative to gay-role speech. In other words, when playing straight characters, the actors' speech is characterized by reduced pitch, greater aperiodicity, and lower harmonic energy compared to gay-role speech.

5.3. INTERPRETATION. Taken together, these findings demonstrate a robust effect of role on both pitch and voice quality, while individual speaker identity does not produce a significant difference once role is considered. Specifically, the results fully support H1: mean f_0 is higher in gay-role speech than in straight-role speech. They also partially support H2, in that gay-role speech shows a higher H1*-H2*, suggesting breathier phonation. However, the expected increase in jitter and shimmer for a breathy voice is not observed; instead, straight-role speech exhibits higher jitter and shimmer, coupled with a lower HNR. One possible explanation is that straight-role speech may incorporate more creaky phonation elements (Podesva 2007; Zimman 2013), which could account for the elevated jitter, shimmer, and reduced HNR. Future studies focusing specifically on creak vs. breathiness could clarify how role-based style shifts interact with non-modal phonation choices.

Overall, these results suggest that the actors systematically manipulate their pitch and voice quality in portraying gay versus straight characters, whereas the two speakers individual differences are not evident once role is taken into account.

Table 2. Summary of fixed effects from the mixed-effects models (reference levels: *Speaker* = Petch, *Role* = Gay).

Dependent Variable	**Predictor**	**Estimate**	**Std. Err**	**z**	**p-value**
f_0	(Intercept)	0.612	0.902	0.679	0.497
	speaker[T]	-0.306	1.267	-0.242	0.809
	role[S]	**-1.008**	**0.183**	**-5.508**	**<0.001**
Jitter	(Intercept)	-0.419	0.973	-0.431	0.666
	speaker[T]	0.214	1.366	0.157	0.875
	role[S]	**0.676**	**0.197**	**3.424**	**<0.001**
Shimmer	(Intercept)	-0.378	0.977	-0.387	0.699
	speaker[T]	0.191	1.372	0.139	0.889
	role[S]	**0.618**	**0.198**	**3.119**	**0.002**
HNR	(Intercept)	0.531	0.936	0.568	0.570
	speaker[T]	-0.267	1.314	-0.203	0.839
	role[S]	**-0.871**	**0.190**	**-4.592**	**<0.001**
H1*-H2*	(Intercept)	0.548	0.933	0.587	0.557
	speaker[T]	-0.283	1.310	-0.216	0.829
	role[S]	**-0.872**	**0.189**	**-4.612**	**<0.001**

6. Discussion. Our results show that Thai male actors produce higher pitch and breathier phonation (indicated by a higher H1*–H2*) when portraying gay characters compared to straight characters, with no effects for any baseline differences between the two speakers. These findings align with some previous studies suggesting that gay men adopt higher-pitched or more breathy speech in certain contexts (Podesva 2007; Barbuio & Paulino 2021; Suire et al. 2020), but they do not corroborate earlier work reporting minimal or even opposite patterns of pitch change (Rendall et al. 2008; Holmes et al. 2024). Taken together, these data add to a broader body of mixed results concerning "gay-sounding" speech (see Gaudio 1994; Munson et al. 2006; Holmes et al. 2024) and highlight the fundamental role of situational or stylistic factors in shaping how speakers realize sexual orientation through phonetic cues.

A notable issue arises in attempting to interpret the observed mismatch between the increased breathiness indicated by the spectral tilt measure (higher H1*–H2*) and the *lower* jitter/shimmer plus *higher* HNR found in gay-role speech. The canonical expectation is that breathy phonation correlates with elevated jitter and shimmer and a lower HNR, due to increased aperiodicity and noise in the vocal signal (Kreiman & Gerratt 2005). One possible explanation is that the straight role may incorporate more creaky voice, thus inflating jitter and shimmer (and reducing HNR), while the gay-role speech avoids such creak. Several studies have specifically tied creaky phonation to enhanced aperiodicity (Podesva 2007; Zimman 2013; Becker et al. 2022), which would naturally raise jitter and shimmer measures. Alternatively, speakers might produce a "cleaner" breathy phonation (which maintains harmonic energy) when portraying gay characters, reducing the cycle-to-cycle variation and yielding lower jitter and shimmer. Future work could would incorporate extra hypothesis testing for creaky voice to find out more details about the mechanisms at work.

6.1. Comparisons with previous research. A recurring theme in the literature on sexual orientation and speech is variability. While classic stereotypes predict higher pitch for gay men, empirical findings vary widely. For instance, Linville (1998) found that men perceived as gay had higher-frequency fricatives (/s/) but no absolute pitch difference, whereas Barbuio & Paulino (2021) reported higher mean f_0 and a wider pitch range among gay men in Brazilian Portuguese. Holmes et al. (2024) observed the reverse pitch effect in a large sample of English-speaking men, casting further doubt on a universal "gay sound." Similar variability characterizes voice quality. Some studies suggest that gay speech styles frequently involve greater breathiness (Podesva 2007), whereas others find little consistent difference in jitter, shimmer, or spectral tilt (Munson et al. 2006).

The present findings from Thai media speech suggest that performed gay speech is pitched higher and more breathy (based on H1*–H2*). Yet, the systematic differences in jitter/shimmer/HNR suggest a more complex interplay of creaky versus breathy phonation strategies across roles, echoing similarly multifaceted patterns in other languages (Zimman 2013; Becker et al. 2022). The fact that role-based effects overshadow any baseline differences between the *actual* sexual orientations of the actors further underscores the degree to which orientation-linked cues are flexible and context-dependent rather than reflecting static physiological traits.

Our findings of higher pitch and breathier phonation for gay-role speech also raise the question of how Thai listeners attend to these cues. Gunter et al. (2020)'s perception-based studies illustrate how listeners socially driven expectations can override or sharpen sensitivity to subtle acoustic variation. Future research is needed to investigate whether Thai listeners actively use pitch and breathiness as signals of orientation or whether these cues are overshadowed by more powerful social stereotypes.

6.2. SOCIOPHONETIC INDEXICALITY. From a sociolinguistic perspective, this performance can be understood through the lens of enregisterment, the process by which particular linguistic features become socially recognized as markers of identity. (Johnstone 2016) conceptualizes enregisterment as the process through which specific ways of speaking are indexed to social categories, often reinforced by media and everyday interactions. Similarly, (Eckert 2008) introduces the idea of an "indexical field," in which a constellation of phonetic features (such as elevated f_0 and increased breathiness) becomes associated with a particular social identity: in this case, gay identity. In our study, the systematic adoption of a higher pitch and breathier phonation in gay-role speech can be seen as an enactment of such an enregistered stereotype. Actors are not merely revealing their innate voice characteristics but are actively mobilizing these acoustic cues as part of a culturally mediated performance that signals a socially recognized gay persona. In Thai media, for instance, these enregistered markers are continually reinforced through repeated portrayals in television and other cultural texts, which in turn shape listeners expectations and perceptions. Future work may build on this framework by exploring how these socially mediated cues interact with listener evaluations, ultimately influencing the broader indexical field of sexual orientation in speech.

6.3. THAI AS A TONAL LANGUAGE. Our data additionally demonstrate that Thai speakers harness pitch and phonation in a tonal language, where pitch is crucial to lexical meaning. Despite this lexical load on f_0, both actors managed to raise their mean pitch for gay portrayals, consistent with previous studies on tonal languages such as Mandarin or Cantonese, showing that tonality does not necessarily preclude stylistic use of pitch (Osatananda & Gadavanij 2019; Munson & Babel 2019). These findings emphasize that language-specific phonological constraints shape but do not eliminate the possibility of stylistic pitch modulation for identity signaling. Thai appears to offer enough latitude for speakers to raise mean f_0 and adjust phonation quality, while still maintaining the distinct tonal contrasts (see also Keating et al. 2023; Graham 2013:on cross-linguistic differences in pitch settings).

6.4. IMPLICATIONS AND FUTURE DIRECTIONS. Overall, these findings underscore the plasticity of speech in indexing sociocultural identities, while the discrepancy between our H1–H2 results and the jitter, shimmer, and HNR values highlights several promising avenues for further investigation. A more detailed account of how Thai actors use breathy and creaky phonationseparately or in tandemwould illuminate the underlying prosodic and sociophonetic mechanisms. In particular, perceptual work examining which facets of voice quality (e.g., breathiness vs. creakiness) listeners associate with "gay" or "straight" roles (Levon 2007; Campbell-Kibler 2011) would complement the production data. Longitudinal or multi-context research, such as analyzing unscripted interviews or more casual interactions, would reveal whether these stylized differences endure outside scripted performances (Podesva et al. 2002). Finally, studying language contact or code-switching contexts, especially among bilingual speakers, may clarify how role-based style shifts intersect with the demands of Thais lexical tone system (Ng et al. 2012; Bahmanbiglu et al. 2017).

By placing our Thai data alongside findings in other languages, we see that sexual orientationlinked speech cues vary significantly across individuals, languages, and contexts, refuting the notion of a single monolithic "gay voice." Instead, speakers selectively deploy multiple acoustic parameters, such as pitch level, voice quality, and even formant shifts, as semiotic resources to construct distinct personae (Podesva & Kajino 2014; Eckert 2008). This study thus highlights the importance of studying orientation-based stylistic variation in diverse linguistic environments, including tonal languages, to gain a more comprehensive picture of how people "sound gay" (or "sound straight").

In conclusion, this project offers empirical insight into how Thai media actors vary pitch and phonation to perform sexual orientation. While higher pitch and breathier phonation align well with some stereotypical depictions of gay-sounding speech, the unexpected pattern of lower jitter and shimmer and higher HNR in gay role speech shows that these parameters must be interpreted together with possible increases in creak for straight roles or more "controlled" breathy voice in the gay style. Ultimately, such findings highlight the nuanced and creative ways in which speakers, whether in scripted performances or everyday conversation, can manipulate multiple layers of the speech signal to signal and interpret identity.

7. Conclusion. This study investigated how two Thai male actors adjusted their speech when portraying gay versus straight characters in televised dramas. Using measures of pitch (mean f_0) and voice quality, we found robust differences linked to performed role, but no significant speaker-specific effects once role was taken into account. Specifically, gay-role speech was characterized by higher pitch and more breathy phonation (higher $H1^*–H2^*$), whereas straight-role speech employed lower pitch and less breathy phonation (lower $H1^*–H2^*$). These findings strongly suggest that speakers can adopt distinct acoustic styles to "sound gay" or "sound straight," regardless of their own baseline voice characteristics.

By situating our results alongside prior research, we contribute to a broader understanding of sexual orientation and speech. Our data agree with studies indicating that pitch and voice quality are both integral to style shifts that index a gay identity, yet they also reinforce the larger conclusion that these cues vary across languages, contexts, and speakers. Importantly, our analysis of Thai fills the gap of studying the interplay of tonal language and sociolinguistic variation in sexual orientation, a domain that has received far less scholarly attention relative to non-tonal languages.

We propose two key directions for future work. First, more naturalistic or conversational data would reveal whether these stylized differences persist beyond scripted media performances. Second, perception studies with Thai listeners would clarify which acoustic cues carry the strongest social meanings for gay-versus-straight personae. Ultimately, the complexity of "gay-sounding" speech in Thai underscores that indexical properties are neither fixed nor universal; rather, they arise through the creative, context-dependent management of linguistic resources within specific cultural and linguistic frameworks.

8. Supplementary materials.

8.1. LITERATURE REVIEW SUMMARY. Table 3 summarizes related works on the acoustic correlates of sexual orientation.

Study	Sample	Key Findings
Gaudio (1994)	4 GM, 4 SM	Pitch range/variability did not significantly predict perceived SO. Listener judgments accurate above chance.
Moonwomon-Baird (1997)	2 SW, 2 LW	SW had higher pitches and greater pitch range; no statistical tests performed.
Waksler (2001)	12 SW, 12 LW	No significant difference in pitch range or variability.
Podesva et al. (2002)	1 SM, 1 GM	SM had higher mean pitch; GM had slower speech rate; no difference in pitch range. Emphasizes role of context.
Smyth et al. (2003)	17 GM, 8 SM	No significant correlation between mean pitch and perceived SO. Higher accuracy in identifying SM vs. GM; discourse context influenced judgments.
Pierrehumbert et al. (2004)	26 SM, 29 GM, 16 SW, 16 BW, 16 LW	F1/F2 indicated hyperarticulated vowels in GM and LW/BW; SO was perceived at above-chance levels.
Munson et al. (2006)	11 SM, 11 GM/BM, 11 SW, 11 LW/BW	No overall effect of SO on mean pitch, pitch range, or spectral tilt. Some formant differences for specific vowels (//, /oŁ/, //).
Rendall et al. (2008)	34 SM, 29 GM/BM, 33 SW, 29 LW/BW	No overall SO effect on mean pitch or pitch range. Some significant formant differences (e.g., F2, F4) in both M's and W's vowels.
Campbell-Kibler (2011)	4 M	/s/-fronting was the strongest predictor of perceived gayness; pitch had minimal effect. Multiple cues interact to shape SO perception.
Zimman (2013)	5 trans M, 5 GM, 5 SM	Trans M perceived similarly to GM; pitch not primary cue. Creaky voice and /s/ skew influenced judgments of gayness.
Sulpizio et al. (2015)	16 SM, 16 GM	German. GM produced higher F1 in //; overall accuracy in identifying SO was low. Language-specific cues affected perception.
Suire et al. (2020)	48 SM, 58 GM, 54 SW	French. No SO effect on mean pitch/jitter in SM. GM showed significantly higher pitch variation and HNR.
Barbuio & Paulino (2021)	7 SM, 7 GM	Portuguese. Mean pitch 11% higher in GM; pitch variability 43% higher in GM; no statistical tests performed.
Holmes et al. (2024)	142 M, 175 W	In natural speech, GM had lower mean pitch/narrower range than SM, challenging stereotypes. Some formant differences for W; many features not tied to SO.

Table 3. Association between sexual orientation (SO) and speech properties across 14 studies, with abbreviations for participant groups. G = gay, S = straight, L = lesbian, W = women, B = bisexual.

8.2. Result boxplots. Below we present five box-plot figures (f_0, Jitter, Shimmer, HNR, H1*-H2*) grouped by speaker-role (G = gay, S = straight, P = Petch, T = Ter.).

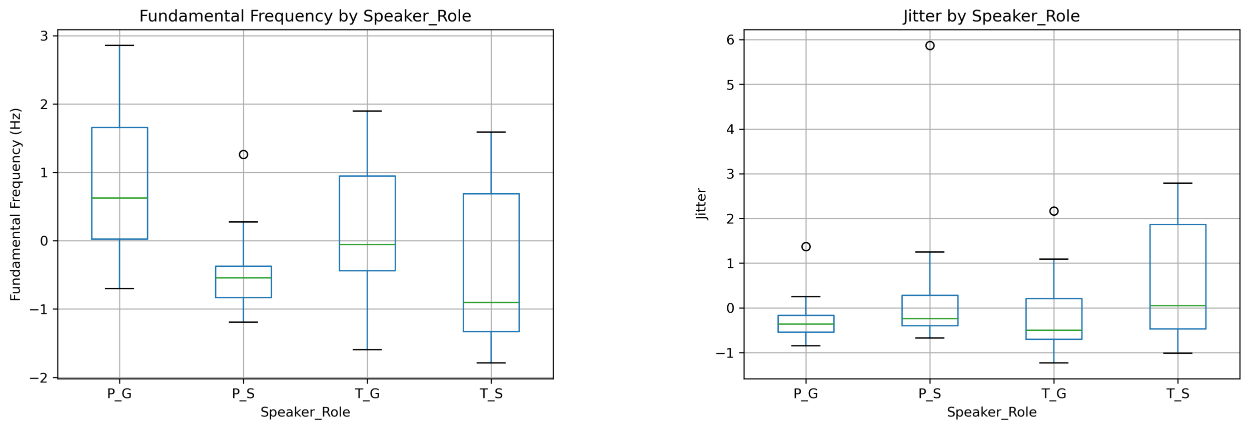

Figure 1. (Left) Box plot of f_0 by speaker-role; (Right) Box plot of Jitter by speaker-role.

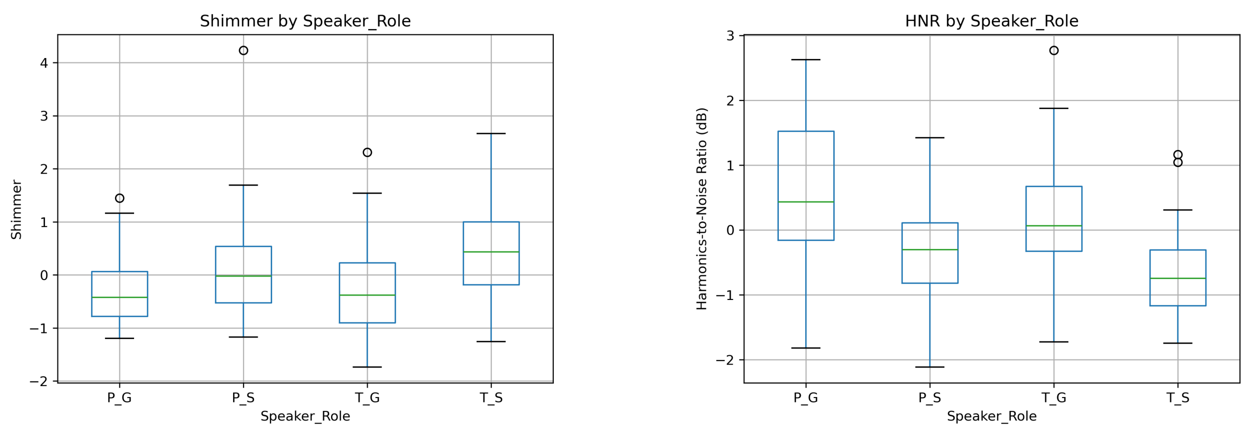

Figure 2. (Left) Box plot of Shimmer by speaker-role; (Right) Box plot of HNR by speaker-role.

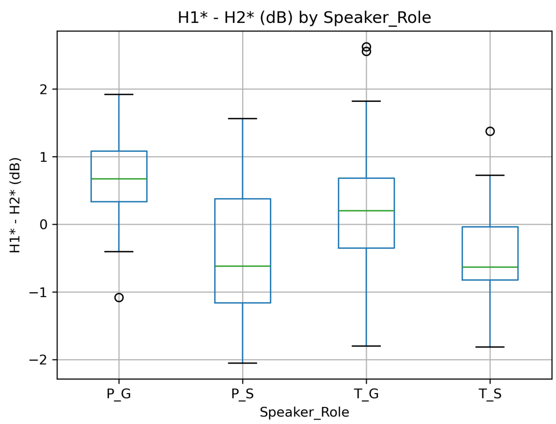

Figure 3. Box plot of H1*-H2* by speaker-role.

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