

# Masculinity and Sexual Orientation as Predictors of Creaky Voice in Australian English Speaking Men

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## Abstract

Pop culture strongly associates creaky voice with young women and, perhaps less strongly, with gay men. However, empirical investigations into variation in creak by gender have produced equivocal findings. This study sought to examine the prevalence of creak in male speech and contribute to the nascent literature covering Australian English (AusE) variation by sexual orientation (SO). Intervals of creak in speech data from male AusE speakers were considered with regard to speaker age, SO, orientation toward traditional male gender roles, and speech topic. Results revealed a complex interaction effect between the first three of these four variables on creak prevalence.

**Index Terms:** sociophonetics, sexual orientation, masculinity, creaky voice, Australian English

## 1. Introduction

### 1.1. Gay Men's Speech

Over the past three decades, much sociophonetic research has investigated the speech of gay men, with early studies seeking to empirically identify the phonetic variants that might index male SO. Fundamental frequency ( $f_0$ ) related metrics have often featured in these studies, but research has failed to produce a consensus as to whether and how  $f_0$  may systematically vary according to speaker SO. Further, the way in which gay male speech has been conceptualised has changed throughout that period. Early studies treated gay male speech as a monolithic category and sought to directly link it to specific phonetic variants ([1, 2]). Subsequent studies have taken a more nuanced approach, examining variation within and between speech communities of gay people in specific geographic locations [3]. Attention has also turned to the ways in which gay and other sexual minority [4] (i.e., not straight) speakers might actively employ phonetic variants to specifically access the social meanings that they index, and in doing so construe and communicate their identities [5].

The vast majority of this work has focused on Northern Hemisphere varieties of English ([1, 2]) and other, mostly European, languages ([6, 7]), although some has examined variation in New Zealand English [8]. However, there remains a gap in scholarly understanding of the phonetic features of gay men's speech in the AusE context (but see [9] regarding perceived-as-gay speech and [10] regarding the acoustics of /s/).

### 1.2. Gender and Masculinity

Hegemonic masculinity describes a combination of social influences and actions which serve both to dominate women and to subordinate other alternative masculinities [11]. In doing so, it privileges the minority of men who embody its ideals, which include toughness, stoicism, and heterosexuality. Being

a hegemony, it polices the ways men are expected to behave, and traits they are expected to adopt, vis-à-vis the performance of gender [12]. The list of these policed attributes is extensive. For example, in addition to avoiding styles of dress and grooming associated with women, in relationships men are expected to adhere to defined gender roles which project dominance and hide vulnerability. In addition, the pressures of hegemonic masculinity dictate that men not deviate from a prescribed range of masculine speech styles [13] under penalty of being labelled unmanly or womanly.

Among the phonetic variables which might situate a speaker inside (or outside) of these licensed speech styles is variation related to  $f_0$ . For example, in American English, falling prosodic contours and lower pitch ([14, 15]) have been linked to sounding masculine. Additionally, male voices and phonetic variants that are perceived as gay are regularly also interpreted as less masculine ([14, 15, 16]).

Openly gay men, as well as other men who openly belong to the sexual minority, necessarily deviate from hegemonic masculinity. It might therefore be the case that they are less likely to be influenced by the pressure to restrict their speech styles than straight men are. This cannot be taken for granted, however, particularly in light of the aforementioned lack of consensus regarding  $f_0$  measurements in gay male speech [1]. We ought to consider the possibility that the effect of differing speaker orientations to masculinity contributed to these studies' mixture of findings. Furthermore, given that gay men are already situated outside, or on the borders of, the masculine hegemony, if masculinity does impact the ways they use  $f_0$ , it may do so in ways that differ from their straight counterparts.

While gender associations for a variable such as pitch are intuitive because the typically larger and wider vocal folds of men usually result in a lower mean  $f_0$  than that of women [17], one variable for which mixed and at times seemingly conflicting gender associations exist is creaky voice.

### 1.3. Creaky Voice

Creaky voice, or creak, is a voice quality characterised by perceptual roughness or gravelyness ([18, 19]) and associated with low and irregular  $f_0$  ([18, 20, 21]). In recent years, creaky voice has been the object of unfavourable commentary in popular culture, often linking it to the speech of young women [22] and sometimes to the speech of gay men ([23, 24]). It might be assumed that this negative appraisal of creaky male voices may relate to its stereotype as feminine, and thereby its deviation from what is licensed by hegemonic masculinity.

However, scholarly investigations suggest a more complex relationship between creak and gender. Whereas early research more often linked creak to English-speaking *male* voices than female, particularly in the United Kingdom ([25, 26]), but also in Australia [27], subsequent studies in the North American context have identified and explored an association between creak and *women's* speech ([19, 28, 29]). In the AusE context, studies have demonstrated that the use of creaky voice *does* vary by gender,

but that the precise nature of this variation is influenced by other facets of speaker identities, such as ethnic and language background [30], and age and race [31]. Despite this wealth of gender-based research and the pop cultural association with gay men's speech, links between creaky voice and SO have less frequently been the object of empirical investigation. Notably though, in American English speakers from California, [32] noted a connection between creaky male voices and being perceived as gay, while [33] discussed the role of creak (alongside falsetto) in facilitating a gay male speaker's adoption of a diva persona, which in turn contributed to the construal and communication of his gay identity.

One might consider that this all results in an apparent paradox. On the one hand, one might predict that speakers who ascribe to the edicts of hegemonic masculinity would avoid creak, given its popular links to feminine and gay male speech styles. On the other hand, such speakers might also be predicted to employ lower f<sub>0</sub>, given its links to being perceived as masculine ([16, 17]). This is despite low f<sub>0</sub> facilitating creaky voice and being one of its acoustic correlates ([18, 19, 20]). However, we note that in [33] the use of creak with falsetto expanded the speaker's f<sub>0</sub> range, which is argued to have indexed expressiveness and the speaker's diva persona.

#### 1.4. Topic-Based Style Shifting

Lastly, topic-based style shifting refers to (usually intraspeaker) linguistic variation according to referential topic. Evidence exists that gay speakers vary their speech when moving between gay and other topics [34], but that not all gay speakers vary their speech in the same way [35]. Additional variables may impact the precise nature of speakers' style shifting. For example, the speech of those whose gender presentation is more typical may vary differently from those whose gender presentation is less so.

## 2. Aims

### 2.1. Predictions

The research presented here forms part of a larger project which aims to help close the gap in scholarly understanding of variation in AusE according to male SO. This study focused specifically on how male speakers' relationships with (hegemonic) masculinity might affect variation in the use of creaky voice. We also examined the role played by topic-based style shifting. Accordingly, we made the following three predictions:

1. Creak will be more prevalent in the speech of gay and other sexual minority men than that of straight men.

This prediction is motivated by findings of earlier studies on creak ([32, 33]). We note the complexity of gendered associations with creaky voice, as well as the apparent contradiction of creak's associations with, on the one hand, feminine and gay male voices and, on the other, low f<sub>0</sub>.

2. Men who value traditional male gender roles more highly will produce less creak than those who value traditional male gender roles less highly.

This prediction is based on the association that exists in pop culture, and in some of the scholarly literature, between creak and the voices of women and of gay men.

3. Gay men will produce more creak when speaking on an LGBTQ topic than on a neutral topic, but this will be modulated by their acquiescence to hegemonic masculinity.

This was motivated by [34] and [35]. No prediction was made regarding the straight male speakers.

## 3. Methods

### 3.1. Participants

Participants were 77 adult male speakers of AusE aged between 18 and 52 years (mean = 30.4), who reported no diagnosed speech or hearing problems and had received all primary and secondary schooling in Australia. 27 were gay, 38 were straight, and 12 reported another SO. This initial sample was later reduced to 71 following outlier removal (see below).

### 3.2. Tasks

Each participant took part in a single, in-person data collection session conducted by the first author in a quiet location which was recorded using a Zoom H6 Portable Recorder at a sampling rate of 44.1 kHz.

Participants engaged in three tasks: a picture description task, a video recount task, and a conversation task. Data analysed in this paper are from the picture description task, which involved the speaker describing nine different photographic images. To examine potential topic-based style shifting, the last three images were deliberately selected to depict (non-sexual) LGBTQ-themed situations. The remaining six were neutral with regard to SO and LGBTQ subjects.

Each participant completed a demographic questionnaire as well as one or more additional surveys. Participants were asked for their SO and were given the option of selecting "gay", "straight" or an open-ended field for other orientations. Other demographic information collected included the speaker's age, his ethnocultural heritage and the area(s) in which he had grown up and attended school; only the first of these is discussed further in this paper.

The additional surveys included the Male Roles Attitudes Scale (MRAS) [36], an instrument which is designed to measure an individual's concordance with statements pertaining to traditional male gender roles, and which has been deployed in previous sociophonetic studies [37]. The MRAS elicits responses to eight statements on a four-point Likert scale (1 = strongly disagree, 4 = strongly agree). Example statements are: "A man always deserves the respect of his wife and children", and "It bothers me when a man acts like a woman".

Participants reporting their SO as "gay" or "other" also responded to a series of surveys designed to measure their relationships with homosexual masculinity, though responses to these are beyond the scope of this paper.

### 3.3. Data Analysis

#### 3.3.1. Demographic and Survey Data Preparation

Mean ratings across the eight MRAS items were calculated, and results z-scored (higher MRAS = more traditional male gender role values). SO was reduced to a two-way distinction between men who were straight and those belonging to the sexual minority, i.e. those who could be described as gay or otherwise not straight. Age was also simplified to create younger ( $\leq 30$  years;  $N = 45$ ) and older ( $> 30$  years;  $N = 32$ ) age brackets.

### 3.3.2. Speech Data Preparation

Orthographic transcriptions of the speech data were automatically generated [38] and hand corrected. These were used for automatic phonemic segmentation and labelling [39]. Macreaper [40] was used to calculate f0 estimates (in Hz) at 10 ms intervals. The union of two methods used to identify creaky voice (hereafter “Union method” [21]) was then used to determine whether or not each f0 estimate coincided with a period of creak: these two methods were the antimode (AM) method [40] and the creak detector (CD) algorithm [41]. If one or both of these methods determined that a particular time stamp was creaky, it was labelled as such. The Union method has been identified as an accurate automatic method of determining whether phonation is creaky [21]. It is most accurate when applied to sonorants only [21], and for this reason only sonorants were examined here.

The AM method ([40]) relies on low f0 to identify creak. f0 distributions are identified for each speaker. These are generally bimodal in nature with the higher peak indicating the mode f0 during modal voice, and the lower peak indicating the mode f0 during creak. The trough between these peaks is the antimode, with all 10 ms intervals with an f0 lower than the antimode labelled as creaky.

In contrast, the CD algorithm combines multiple metrics known to correlate with creak, namely H2-H1, residual peak prominence, power peak parameters, and inter-pulse similarity and inter-frame periodicity metrics [41]. A probability of creak presence is calculated for each 10 ms interval, which is converted to a binary creak decision; this decision depends on what probability threshold the algorithm is set to use. A threshold of 0.05 was used here, as has been previously used for male AusE speakers ([21, 30]).

The Union method output was used to calculate the percentage of each speaker’s f0 estimates that were creaky. 6 speakers were shown to be outliers, with over 40% of their sonorant f0 estimates being creaky. Data from these outliers were excluded, resulting in a final sample of 71 speakers (straight= 36, gay= 24, other= 11; ≤30= 42, >30= 29).

### 3.3.3. Statistical Modelling

To examine which variables would predict a higher probability of creak, a logistic mixed effects regression model was constructed using the *lme4* package in R [42]. The presence or absence of creak at each 10 ms interval was the binary outcome variable (*creak*). Fixed factors were: *MRAS*, a continuous variable (z-scored); *SO* (*gay and other/straight* with reference *gay and other*); *age* (≤30/>30 with reference ≤30); *topic* (*neutral/LGBTQ* with reference *LGBTQ*). Initially, these fixed effects were included in four 3-way interactions. A random intercept was included for *speaker*, with a random slope for *topic*.

The most parsimonious model was identified by a process of model reduction, removing at each step the highest nonsignificant term with the greatest *p*-value. At each stage the resulting model was compared to the preceding one using the *anova* function to test whether the more complex model had been a significantly better fit. The final model contained a single 3-way interaction between *SO*, *MRAS* and *age*, while *topic*, having lacked significance, had been removed from the fixed effects structure entirely. The structure of this final model was:

$$creak \sim MRAS*age*SO + (1 + topic | speaker)$$

## 4. Results

There was a significant interaction between *MRAS*, *age*, and *SO* (see Table 1 for the model summary). Figure 1 shows that, amongst younger ≤30 speakers, *gay and other* speakers had a higher probability of producing creak than *straight* speakers. In the ≤30 group a higher *MRAS* score resulted in a higher probability of creak: this was true for speakers of both SOs.

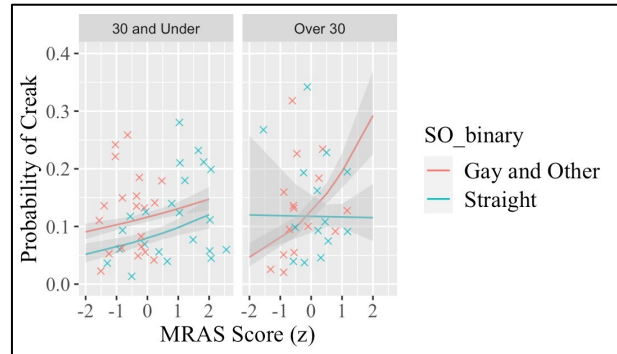


Figure 1: Effect of *SO*, *MRAS* score and age on probability of creak

In contrast, in the >30 group, higher *MRAS* did not lead to a greater probability of creak for the *straight* men. However, for *gay and other* men, increasing *MRAS* led to an even greater increase in creak probability than for their ≤30 counterparts. In the older >30 group, the model predicted a higher probability of creak for the *gay and other* speakers than the *straight* speakers when *MRAS* was higher. This was not the case, however, when *MRAS* was low.

Table 1. Fixed Effects of GLMER

Term	Est	Std Err	Stat	p-value
Intercept	-2.03	0.038	54.03	< 0.001***
MRAS	0.14	0.037	3.76	< 0.001***
age>30	0.08	0.059	1.39	0.164
SOstr	-0.42	0.064	-6.49	< 0.001***
MRAS:age>30	0.39	0.092	4.31	< 0.001***
MRAS:SOstr	0.09	0.054	1.72	0.086
Age>30:SOstr	0.35	0.085	4.15	< 0.001***
MRAS:age>30:SOstr	-0.64	0.102	-6.23	< 0.001***

## 5. Discussion

The results were partially consistent with our first prediction: among the younger age group, gay and other sexual minority men employed greater proportions of creak than straight men, with this also being the case among older gay men with higher *MRAS* scores. This would align with a characterisation of creaky voice as a feminine phonetic variant that these gay and other men, having already been marginalised from the masculine hegemony as a result of their *SO*, have less motivation to avoid than straight men.

However, contrary to our second prediction, among all groups except the older straight men, an increase in *MRAS* led to an *increased* probability of creak. This means that younger men who more highly value traditional male gender roles employ *more* creak than those who value it less highly, regardless of sexual orientation; this is also predicted for older gay and other men. This observation is clearly not reconcilable with creak

carrying an exclusively feminine social meaning. Therefore, we might entertain a situation wherein creak's present feminine sociolinguistic connections emerged following women's adoption of what had thitherto been a masculine speech resource, as evidenced by findings such as [27], and that creak may retain at least some of its erstwhile masculine sociolinguistic meanings.

Additionally, in seeking to explain this apparent inconsistency, we need to revisit the acoustic characteristics of creaky voice: specifically, that it is frequently (though not exclusively) connected to low  $f_0$ . It may be that the increasing probability of creak among the younger men as their MRAS scores more closely conform to traditional male gender roles could be explained by their attempting to access a particularly low  $f_0$ . Should this be the case, we might theorise that this is motivated by their desire to access masculine social meanings associated with low  $f_0$ . The greater probability of creak for the gay and other speakers compared to the straight speakers (also among the younger men) may also result from their accessing low  $f_0$  values while speaking. However, rather than to access social meanings situated within the indexical field of low  $f_0$  itself, the aim here may be to assist in the expansion of the  $f_0$  ranges of their utterances; this would be consistent with suggestions in [33].

The patterns of creak observed in the over-30 group are substantially different, however. Importantly, no significant effect of increasing MRAS score exists for the straight men in that age bracket. We propose possible explanations here. First, older speakers might generally be expected to be more settled and comfortable in their identities, and therefore feel less need to manipulate their voices to conform to social pressures. An alternative explanation could be that the popularity of "alpha male" influencers such as Andrew and Tristan Tate, who espouse interpretations of masculinity that are very often toxic and misogynist [43], may be resulting in a preoccupation with indexing masculinity by, for example, reducing pitch, among young men who more closely share those controversial figures' social values. The fact that the target audience of these creators skews young [43] may explain why the same effect is not seen among the straight men in the older age bracket. Notably, however, we see for the gay and other sexual minority men in that older bracket an even greater effect of increasing MRAS than in the younger bracket. Here we might suggest that, having come of age in an era when being identifiable as gay (or as otherwise possessing an SO outside the heteronormative standard) could pose a very real threat to one's reputation, livelihood or even safety [44], men in this group who did believe in traditional masculine values made a particular effort to index masculinity with their voices, such as by speaking in a low pitch and consequently with more creak. Their speech styles may have remained subsequently static, notwithstanding increasing acceptance of alternative SOs over time. We note, however, the low number of speakers in this group in our sample and suggest that further research is required to confirm this idea.

Next, even more generally, when seeking to explain the apparent inconsistency, we should also consider two theoretical perspectives that could explain potential confounds. First is an intersectional perspective. If young Australian women's creak prevalence varies according to other demographic factors such as ethnocultural background [30], it is possible, if not likely, that this, or another social variable, is interacting with SO, age and MRAS for Australian men too.

Second, since speakers can also access many temporary stances and attitudes using suprasegmental variants like creak, it has been argued that its social meanings ought to be decoupled entirely from (directly indexing) gender [45]. For example, it has

been suggested that creak might index, in some situations, negative affect and affective disengagement or, in others, being relaxed [46] and more authoritative [30]. It is certainly conceivable that our young speakers who are more influenced by hegemonic masculinity would be more motivated to project authority than others, and, potentially, to take a relaxed or disaffected stance to avoid any feminine and gay sociolinguistic meanings associated with being animated or expressive.

Lastly, the third prediction was not supported, as the probability of creaky voice was not significantly different when speakers, whether gay and other or straight, were describing the LGBTQ themed images compared with the neutrally themed images.

## 6. Conclusion

This study sought to illuminate how speaker SO and orientation toward masculinity influence the production of creaky voice among Australian men, and also the role played by referential topic. Results showed that, consistent with predictions, there is a higher probability of creak in the voices of younger men who are gay or otherwise belong to the sexual minority than younger men who are straight. Contrary to predictions, however, the probability of producing creak is higher among younger men who place more value in traditional male gender roles than those who place less value in it. For older speakers the relationship is more complex. Increasing levels of agreement with male gender roles results in increased probability of creak even more than it did for the younger men, but this effect occurs only among gay and other sexual minority men. Increasing agreement with male gender roles has no such effect on the probability of creak for older straight men. Further, in terms of probability of creak, a difference between older straight men and older gay and other sexual minority men exists only for speakers with high levels of agreement with male gender roles. It is apparent, therefore, that sociolinguistic variability in the use of creaky voice is particularly complex, and is likely more nuanced than can be completely explained with reference to macro social categories. Future studies might continue the examination of its role in the construction of particular indexical stances and styles, and the effect of finer-grained elements of speakers' sexual identities.

## 7. References

- [1] Gaudio, R. P., Sounding gay: Pitch properties in the speech of gay and straight men. *American speech*, 69(1), 30-57, 1994.
- [2] Pierrehumbert, J. B., Bent, T., Munson, B., Bradlow, A. R., & Bailey, J. M., The influence of sexual orientation on vowel production. *The Journal of the Acoustical Society of America*, 116(4), 1905-1908, 2004.
- [3] Podesva, R. J., & Van Hofwegen, J., How conservatism and normative gender constrain variation in inland California: The case of /s/. *University of Pennsylvania Working Papers in Linguistics*, 20(2), 15, 2014.
- [4] Daniele, M., Fasoli, F., Antonio, R., Sulpizio, S., & Maass, A., Gay voice: Stable marker of sexual orientation or flexible communication device?. *Archives of Sexual Behavior*, 49, 2585-2600, 2020.
- [5] Podesva, R. J., The California vowel shift and gay identity. *American speech*, 86(1), 32-51, 2011.
- [6] Baeck, H., Corthals, P., & Van Borsel, J., Pitch characteristics of homosexual males. *Journal of Voice*, 25(5), 211- 214, 2011.
- [7] Kachel, S., Simpson, A. P., & Steffens, M. C., "Do I sound straight?": Acoustic correlates of actual and perceived sexual orientation and masculinity/femininity in men's speech. *Journal of Speech, Language, and Hearing Research*, 61(7), 1560-1578, 2018.

- [8] Hazenberg, E., *Liminality as a lens on social meaning: A cross-variable analysis of gender in New Zealand English*. [Doctoral dissertation] Victoria University of Wellington. Wellington, New Zealand, 2017
- [9] Shea, T., Gibson, A., Szakay, A., & Cox, F., Australian English speakers' attitudes to fricated coda /ʌ/. *Australian Journal of Linguistics*, 43(1), 87-119, 2023.
- [10] Szalay, T., Holik, J., Nguyen, D. D., Morandini, J., & Madill, C. J., Comparing first spectral moment of Australian English /s/ between straight and gay voices using three analysis window sizes. In *Proceedings of the 24th INTERSPEECH* (pp. 20-24). Dublin, Ireland, 2023.
- [11] Connell, R.W., & Messerschmidt, J.W., Hegemonic Masculinity: Rethinking the Concept. *Gender & Society*, 19(6), 829-859, 2005.
- [12] Butler, J., Performative acts and gender constitution: An essay in phenomenology and feminist theory. *Theatre Journal*, 40(4), 519-531, 1988.
- [13] Zwicky, A. M., Two lavender issues for linguists. In Anna Livia & Kira Hall (eds.), *Queerly phrased: Language, gender, and sexuality*, 21-34. New York: Oxford University Press, 1997.
- [14] Munson, B., The acoustic correlates of perceived masculinity, perceived femininity, and perceived sexual orientation. *Language and Speech*, 50(1), 125-142, 2007.
- [15] Drager, K., Hardeman-Guthrie, K., Schutz, R., & Chik, I., Perceptions of style: A focus on fundamental frequency and perceived social characteristics. In L. Hall-Lew, E. Moore, & R. J. Podesva (Eds.), *Social meaning and linguistic variation: Theorizing the third wave* (pp. 176-196). Cambridge University Press: Cambridge, United Kingdom, 2021.
- [16] Campbell-Kibler, K., & miles-hercules, d., Perception of gender and sexuality. In J. S. Ehrlich, M. Meyerhoff, & J. Holmes (Eds.), *The Routledge handbook of language, gender, and sexuality* (pp. 123-136). Routledge, 2021.
- [17] Seikel, J. A., Drumright, D. G., & King, D. W., *Anatomy & physiology for speech, language, and hearing* (5th ed.). Cengage Learning: Clifton Park, NY, United States of America, 2016.
- [18] Dallaston, K. and Docherty, G., The quantitative prevalence of creaky voice (vocal fry) in varieties of English: A systematic review of the literature. *PLoS ONE*, 15(3), 2020.
- [19] Wolk, L., Abdelli-Beruh, N. B., & Slavin, D., Habitual use of vocal fry in young adult female speakers. *Journal of Voice*, 26(3), 111-116, 2012.
- [20] Keating, P. A., Garellek, M., & Kreiman, J., Acoustic properties of different kinds of creaky voice. In *Proceedings of the 19th International Congress of Phonetic Sciences (ICPhS 2019)* (pp. 2-7). Melbourne, Australia: International Phonetic Association, 2019.
- [21] White, H., Penney, J., Gibson, A., Szakay, A., & Cox, F., Evaluating automatic creaky voice detection methods. *The Journal of the Acoustical Society of America*, 152(3), 1476-1486, 2022.
- [22] Swannell, C., Please stop frying your vocals, ladies. *The Medical Republic*. Retrieved from <https://www.medicalrepublic.com.au/please-stopfryingyourvocals-ladies/18024>, 2023, September 26.
- [23] Shariatmadari, D., Do you sound gay? What our voices tell us – and what they don't. *The Guardian*. Retrieved from <https://www.theguardian.com/commentisfree/2015/jul/17/campthe-voice-gay-rights>, 2015, July 17.
- [24] Cushing, S., *Be you, voice and all* [Video]. TikTok. Retrieved from <https://www.tiktok.com/@sam.cushing/video/6825796618541960453>, 2020, December 5.
- [25] Henton, C. and Bladon, A., Creak as a sociophonetic marker. In Hyman, L. M. and Li, C. N. (Eds), *Language, speech, and mind: Studies in honour of Victoria A. Fromkin* (pp. 3-29). Routledge, 1998.
- [26] Stuart-Smith, J., Glasgow: Accent and voice quality. In Foulkes, P. and Docherty, G. (Eds) *Urban voices: Accent studies in the British Isles*, (pp. 203- 222). Arnold, 1999.
- [27] Pittam, J., Listeners' evaluations of voice quality in Australian English speakers. *Language and Speech*, 30(2), 99113, 1987.
- [28] Podesva, R. J., & Callier, P., Voice quality and identity. *Annual review of applied Linguistics*, 35, 173-194, 2015.
- [29] Podesva, R. J., & Szakay, A., Gender differences in the acoustic realization of creaky voice: Evidence from conversational data collected in Northern California. *Journal of the Acoustical Society of America*, 134(5\_Supp), 4238-4238, 2013.
- [30] White, H., *Creaky Voice in Australian English*. [PhD Thesis] Macquarie University. Sydney, Australia, 2023.
- [31] Loakes, D., & Gregory, A., Voice quality in Australian English. *JASA Express Letters*, 2(8), 2022.
- [32] Zimman, L., Hegemonic masculinity and the variability of gay-sounding speech: The perceived sexuality of transgender men. *Journal of Language and Sexuality*, 2(1), 1-39, 2013.
- [33] Podesva, R. J., Phonation type as a stylistic variable: The use of falsetto in constructing a persona 1. *Journal of Sociolinguistics*, 11(4), 478-504, 2007.
- [34] Levon, E., Teasing apart to bring together: Gender and sexuality in variationist research. *American Speech*, 86(1), 69-84, 2011.
- [35] Dickson, V., & Turner, Y., Pulling out all the stops: Referee design and phonetic correlates of gay men's English. *Lifespans and Styles*, 1, 3-11, 2015.
- [36] Pleck, J. H., Sonenstein, F. L., & Ku, L. C., Attitudes toward male roles among adolescent males: A discriminant validity analysis. *Sex Roles*, 30(7), 481-501, 1994.
- [37] Levon, E., Categories, stereotypes, and the linguistic perception of sexuality. *Language in Society*, 43(5), 539-566, 2014.
- [38] IBM Corporation, IBM Watson Speech to Text. Retrieved from <https://www.ibm.com/watson>, 2023.
- [39] Schiel, F., Automatic Phonetic Transcription of NonPrompted Speech. In *Proceedings of the International Congress of the Phonetic Sciences* (pp. 607-610), San Francisco, USA, 1999.
- [40] Dallaston, K., & Docherty, G., Estimating the prevalence of creaky voice: A fundamental frequency-based approach. In *Proceedings of the 19th International Congress of Phonetic Sciences. Australasian Speech Science and Technology Association Inc* (pp. 532-536). Melbourne, Australia, 2019, August.
- [41] Drugman, T., Alku, P., Alwan, A., & Yegnanarayana, B., Glottal source processing: From analysis to applications. *Computer Speech & Language*, 28(5), 11171138, 2014.
- [42] Bates, D., Mächler, M., Bolker, B. & Walker, S., Fitting linear mixed-effects models using lme4. *Journal of Statistical Software*, 67(1), 1-48, 2015.
- [43] Wescott, S., & Roberts, S., Andrew Tate's extreme views about women are infiltrating Australian schools. We need a zero-tolerance response. *The Conversation*. Retrieved from <https://theconversation.com/andrew-tates-extremeviews-aboutwomen-are-infiltrating-australian-schools-we-need-a-zero-tolerance-response-229603>, 2014, May 10.
- [44] Tomsen, S., Masculinity and homophobic violence in Australia's recent past. *Sexuality & Culture*, 21, 813-829, 2017.
- [45] Becker, K., & Zimman, L., Beyond binary gender: creaky voice, gender, and the variationist enterprise. *Language Variation and Change*, 34(2), 215-238, 2022.
- [46] Ligon, C., Rountrey, C., Vaidya Rank, N., Hull, M., and Khidr, A., Perceived desirability of vocal fry among female speech communication disorders graduate students. *Journal of Voice*, 33(5). 805.e21-805.e35, 2019.