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Queer Events, Relationships, and Sports: Does Topic Influence Speakers' Acoustic Expression of Sexual Orientation?

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Abstract

Studies on the acoustic parameterization of actual and perceived sexual orientation yielded inconclusive findings. One reason for this could be different linguistic and situational factors underlying these studies. In the present research, we aim to illuminate inconsistent findings by systematically varying the way sexual orientation was made salient in interview topics: Lesbian/gay and straight women and men (n = 72) were asked to answer questions referring to lesbian/gay issues, to their own sexual orientation, and to a non-sexual orientation topic. Applying a person perceptions approach that provides a holistic measure for phonetic variation across topics, raters (n = 35) were asked to judge speakers' sexual orientations. Overall, straight speakers were rated as straighter than lesbian/gay speakers. Contrary to expectations, this difference was largest in the control condition. Results are discussed in terms of the same topic having differential effects on different speaker groups.

Index Terms: sexual orientation, gender, text topic, perceptual phonetics

1. Introduction

Being auditorily perceived as lesbian/gay can have severe consequences. For example, lesbian/gay-sounding individuals were judged less suitable for leadership positions compared to straight-sounding individuals in the context of job interviews [1, 2]. Moreover, gay-sounding men were disadvantaged as applicants for adoptions, even though they were judged warmer and more suitable for raising children than straight men based on just one sentence [3]. One fundamental process for sexual orientation discrimination based on voices is gender-related stereotyping [4, 5], often guided by gender-inversion heuristics [6]: Lesbian/gay individuals are stereotyped as less gender-conforming than straight individuals. Correspondingly, lesbian/gay-sounding speakers were attributed less gender-typical personality traits, fields of study, sports [2], and diseases [7]. Consequently, it appears both scientifically and socially relevant to understand which acoustic parameters are used to make judgments on sexual orientation and how self-identified lesbian/gay and straight speakers differ from each other.

Current evidence on acoustic correlates of speakers' actual and perceived sexual orientation is inconsistent. For instance, although some studies found, in line with gender stereotypes, the mean fundamental frequency of gay men to be higher than for straight men [8, 9], the majority of studies showed no difference for these two groups [10, 11, 12, 13, 14, 15, 16]. This mixed pattern of findings can be transferred to female speakers and other acoustic features investigated so far, such as f0 range, spectral moments of /s/, acoustic vowel space features, voice quality parameters, or even duration measures (for a review on women, see [17]; for men, see review in [18]). In addition to different languages (e.g., American and Canadian English, Spanish, French, German, Italian, Czech, Dutch) and divergent conceptualizations of and methods for determining sexual orientation (e.g., dichotomous choice vs. interval scale), contextual factors seem particularly suitable for explaining the inconsistent result patterns.

Based on a differentiation by Waksler [19], contextual factors can be distinguished in linguistic and situational ones. Linguistic factors include, for instance, the type and topic of the text. The inconsistent findings for women's mean f0 may be due to the fact that significant differences between lesbians and straight women were only found using connected texts [20] instead of single words or lists of sentences [12, 13, 17]. This can be explained by the increased adequacy of connected texts to map intonational features (e.g., [9]). In addition to text type, studies also suggest an influence of text topic on the stereotypical coding of sexual orientation: When gay men read an emotionally dramatic instead of a scientifically neutral text, their sexual orientation was perceived more accurately [21].

Situational factors encompass features of the external (e.g., time, space, interlocutors) and internal (e.g., action goal) situation of a speaker. Studies on cross-situational comparisons investigated intra-speaker variation by recording the same male speakers in different situations (social group, in social one-on-one, or a professional one-on-one situation; [22, 23, 24]) or asking them to read the same text in a neutral, a gay, or a straight fashion [25, 26, 27]. However, most of them have limited explanatory power since they used small samples only (n < 6). One remarkable exception is a study by Cartei and Reby [28] using a larger set of speakers: They showed that male actors (n = 15) produced stereotype-conforming mean f0, f0 variation, mean F1, F2, and F4 when performing gay and straight roles.

The purpose of the present study was to elucidate the inconsistent pattern of acoustic correlates of sexual orientation by investigating the impact of contextual factors. To maximize effects, we considered linguistic and situational factors integratively by systematically varying the degree to which a speaker's sexual orientation was made salient between different interview topics. Since the number of studies on sexual

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orientation comparing women and men (and addressing female speakers at all) is small, lesbian/gay and straight women and men were included. Using a person perception approach (cf. [29]), we aimed to complement the analysis of individual acoustic parameters by asking raters to judge speakers' sexual orientations, which provided us with a holistic measure of whether speakers' acoustic features differed on a more global level in accordance with topic. Since the majority of previous studies found lesbian/gay speakers to sound less straight than straight speakers [4, 11, 12, 13, 14, 15, 18, 21, 30, 31], using a person perception approach seems reasonable. We hypothesized the following:

H1: We expected straight speakers to be perceived as straighter than lesbian/gay speakers (main effect of speaker sexual orientation).

H2: We expected the difference in perceived sexual orientation for lesbian/gay and straight speakers to be larger in the two conditions in which sexual orientation is referred to (lesbian/gay events, ideal partner) than in the control condition (sports; interaction effect of speaker sexual orientation and topic).

H3: We expected the differences in perceived sexual orientation for lesbian/gay and straight speakers to be larger for men than for women (interaction effect of speaker sexual orientation and speaker gender).

In order to provide a study that meets the highest scientific standards possible and contribute to the open science movement, we conducted a sample size calculation and pre-registered our hypotheses as well as other aspects of the present study on Open Science Framework prior to data analysis (https://archive.org/details/osf-registrations-cvkez-v1). To our knowledge, this is the first study on acoustic correlates of sexual orientation doing so.

2. Method

2.1. Speakers and audio stimuli

Speech data was collected from 111 speakers attending a study advertised to investigate the interrelation of sexual orientation and voice. Speakers who did not permit the use of their recordings in the present perception experiment (n = 14) or indicated a considerable level of bisexuality (Kinsey-like scale 3-5; n = 13) were excluded[1]. Out of the remaining speakers, we randomly selected an equal number of lesbian/gay (Kinsey-like scores: 1-2) and straight (Kinsey-like scores: 6-7) women and men each (n = 18 per group). Random selection was done in order to reduce experimenter effects. All speakers were German natives who were diverse with respect to the dialect regions in which they had spent most of their lives[2]. Speakers did not indicate any speaking, voice, or hearing disorder. They age ranged between 20 and 30 years (M = 24.17, SD = 2.26). The four speaker groups did not differ in socio-demographic characteristics (ethnicity, educational level, or age).

Speech data was collected in a sound-treated lab under standardized conditions by a same-gender experimenter for female [32]and male speakers [33]. Recordings were done at a sampling rate of 44.1 kHz with a 16-bit amplitude resolution using a capacitor microphone (AKG C1000S) linked to an audio interface pre-amplifying the speech signal (M-AUDIO Fast Track). Among others, we elicited spontaneous recordings of connected speech using a semi-structured interview whereby the likelihood of intra- and interindividual variation was increased. With one question each, text topic was varied on three levels by making sexual orientation salient to different degrees: a) lesbian/gay reference ("What do you think about lesbian and gay events such as LGBTIQA* prides?"), b) reference to one's own sexual orientation ("What are your expectations of a relationship and the ideal partner regarding look, personality traits, and behavior?"), and c) no reference to sexual orientation ("Do you have a favorite sport that you follow in the media and/or practice yourself?"; control condition). To control for order effects, speakers were randomly assigned to one of two conditions (asking questions in the presented order or vice versa). The experimenters ensured that the response duration of one minute for each question was neither substantially undercut (asking follow-up questions) nor exceeded (transitioning to the next question). During the interview session, experimenter and speaker sat opposite of each other with the microphone positioned in a distance of 10-15 cm from the speaker's mouth.

To increase the likelihood of self-stereotyping, only utterances that included an ego reference were selected. Three utterances for each speaker per topic were extracted (3.5-5.5s) and randomly assigned to one of three stimulus subsets to avoid high load for raters. Hence, each subset contained just one utterance for each speaker per topic. For few female speakers, only two utterances per topic could be extracted due to technical issues. This resulted in 637 stimuli in total (324 male, 313 female), almost equally distributed to the three subsets (212 or 213 utterances)[3]. Intensity of each stimulus was normalized to 70dB SPL.

2.2. Design and rater sample

We employed a 2 (speaker sexual orientation: lesbian/gay vs. straight) × 2 (speaker gender: female vs. male) × 3 (topic: no reference to sexual orientation vs. lesbian/gay reference vs. reference to one's own sexual orientation) within-raters design. The a-priori power calculation was done using G*Power Version 3.1.9.6 [34]. For testing H1-3 using an ANOVA with three within-factors, we needed analyzable data from 28 raters in order to detect small to medium effects of f = .2 with a power

[1] The original scale from Kinsey et al. [35, 36] comprised sexual experiences and performance and ranged from 0 ("exclusively heterosexual") to 6 ("exclusively homosexual") with additional labels for intermediate scale points. For the present study, we referred to sexual self-identification ("Regarding sexual orientation, I identify as...") on a scale ranging from 1 ("exclusively lesbian/gay") to 7 ("exclusively straight").

[2] The speakers spent 4 to 27 years in one federal state most of their lifetime (M = 18.86, SD = 4.39). Fourteen indicated Thuringia, eleven Saxony-Anhalt, ten Berlin, nine Saxony, seven Lower Saxony, four each Berlin and Baden-Wuerttemberg, three each North-Rhine Westphalia and Mecklenburg-Western Pomerania, and one each Hamburg, Hesse, and Rhineland-Palatinate.

[3] Since sexual orientation information is potentially stigmatizing, the informed consent did not include an option to make the stimuli publicly available to other researchers for ethical reasons. The stimuli are available upon request only.

of 1 – β = .95 at a significance level of α = .05. Allowing for 20% attrition, we collected data from 35 participants.

Thirty-five raters took part in an online study entitled "Perception of German Speakers' Sexual Orientation". The online crowd-sourcing platform Clickworker was used for their recruitment. All of them consented to pseudonymized storage of their data, anonymized data analysis, and anonymized publication.

The sample comprised English native participants currently living in Great Britain only (34 born in Great Britain, 1 born outside of Europe) whose self-reported German language skills did not exceed basic knowledge (not higher than CEFR level A1). The likelihood of understanding German was minimized to assure a clear focus on the acoustic-phonetic parameters instead of the utterance content during the rating. The sample consisted of 17 females, 17 males, and one person who preferred not to categorize their gender. Raters' age ranged between 21 and 69 years (M = 39.03, SD = 10.60). Regarding sexual orientation, the sample was heterogenous as well: While the majority identified as straight (n = 29), some participants reported to be bisexual (n = 3), lesbian/gay (n = 2), or pansexual (n = 1). None of them reported to be diagnosed with a speech, language, or hearing disorder. All participants rated an at least mediocre level of concentration during the study (≥ 5 on a scale ranging from 1 – "not at all concentrated" to 7 – "very concentrated"; M = 6.69, SD = .53).

2.3. Procedure

The experiment was implemented online using PsyToolkit [37, 38]. Raters were randomly assigned to one of the three subsets in order to avoid tiredness. Within each subset, stimuli were blocked by speaker gender; blocks and stimuli within gender blocks were presented randomly. Participants were asked to judge the sexual orientation of each speaker by rating the corresponding stimuli on a 7-point scale (1 – "lesbian/gay", 7 – "straight") relying on their gut feeling, and were instructed to answer as quickly as possible. Responses could be entered via mouse click within a 5-seconds time frame after stimulus offset, otherwise the request "Please respond faster!" appeared on the screen. Response times ranged between 476 and 2363 ms (M = 1129.5, SE = 396.5) and did not vary due to any of the factors involved in the experimental design, all ps > .082, all η_p^2 < .086. Each rater heard one stimulus per topic for every speaker only once. Prior to the experimental trials, a practice run with 5 stimuli for female and male speakers each was performed, with stimuli which were not used thereafter. Moreover, we collected some psychological characteristics of the raters not relevant for this study. Raters were paid £5,20 for their participation in the approximately 40-minutes study.

3. Results

Ratings of perceived sexual orientation for the different utterances for each speaker per topic were integrated and averaged across speakers, since the preregistered hypotheses neither referred to utterance- or speaker-wise analyses. In line with our sample size rationale, perceived sexual orientation ratings were submitted to a 2 (speaker sexual orientation: lesbian/gay vs. straight) × 2 (speaker gender: female vs. male) × 3 (topic: no reference to sexual orientation vs. lesbian/gay reference vs. reference to one's own sexual orientation) repeated-measures ANOVA. For an overview of the coefficients, please see Table 1. In case of significant interaction effects, simple-effects tests with Bonferroni adjustment were computed.

Table 1: *Main and interaction effects of topic, speaker sexual orientation (SO), and speaker gender on perceived sexual orientation.*

Effect	*F* ratio	*Df*	η_p^2
Gender	3.60	1,34	.096
Topic	3.73*	2,33	.184
SO	128.25***	1,34	.790
Gender × Topic	5.02*	2,33	.233
Gender × SO	135.01***	1,34	.799
Topic × SO	3.26*	2,33	.059
Gender × Topic × SO	3.01	2,33	.154

Note: $^*p < .05$, $^{**}p < .01$, $^{***}p < .001$

The main effect of speaker sexual orientation was significant: As predicted in H1, straight speakers (M = 4.67, SE = .08) were perceived as much straighter compared to lesbian/gay speakers (M = 4.16, SD = .08). Additionally, a main effect of topic occurred: Counter-intuitively, speakers were perceived as straighter when speaking to the topic with lesbian/gay reference (M = 4.49, SE = .08) compared to the condition where no reference to sexual orientation was made (M = 4.36, SE = .08), p = .029; no significant difference occurred in comparison to the topic referring to one's own sexual orientation (M = 4.67, SE = .08), p > .166. The main effect of gender was not significant.

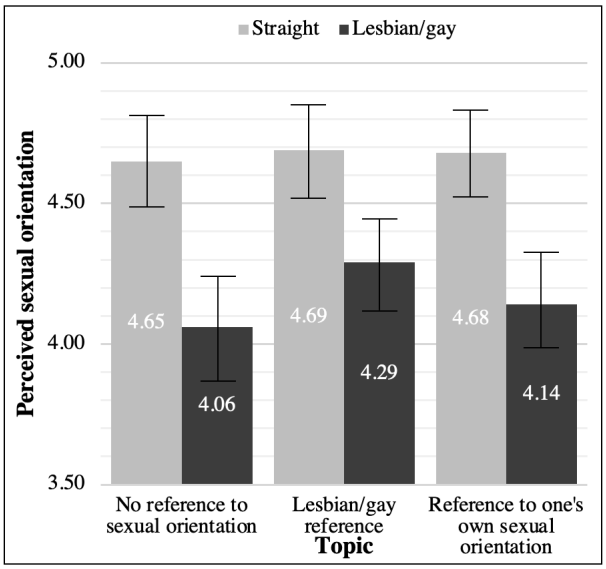

Figure 1: *Perceived sexual orientation* (1 – lesbian/gay; 7 – straight) *differing for combinations of speaker sexual orientation and topic.*

Three significant two-way interactions qualified the main effects. In order to address H2, we first focused on the interaction of speaker sexual orientation and topic. Please see Figure 1 for a graphical illustration (error bars indicate 95% CIs). For all three topics, straight speakers were significantly rated as straighter than lesbian/gay speakers, p < .001. Contradicting our prediction, the effect of sexual orientation was largest for the condition where no reference was made to sexual orientation (p < .001, η_p^2 = .700) and smaller for the topic referring to one's own sexual orientation (p < .001, η_p^2 = .580)

as well as the topic with lesbian/gay reference ($p < .001$, $\eta_p^2 = .512$). Interestingly, when holding sexual orientation constant, there were no differences between topics for straight speakers ($p = .721$, $\eta_p^2 = .020$), but for lesbian/gay speakers ($p = .013$, $\eta_p^2 = .231$). Again, the counterintuitive pattern described above emerged: Lesbian/gay speakers were perceived as straighter when speaking to the topic with lesbian/gay reference ($M = 4.29$, $SE = .09$) than when speaking to the topic without any reference to sexual orientation ($M = 4.06$, $SE = .09$). This could be taken as a hint that the main effect of topic is driven by the lesbian/gay speakers.

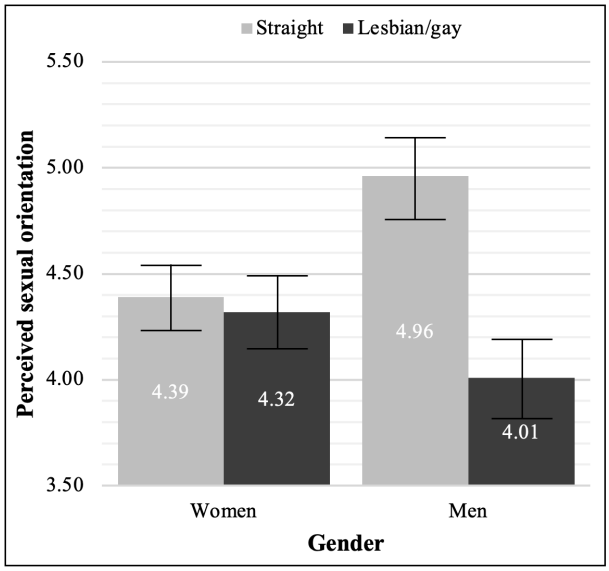

Figure 2: *Perceived sexual orientation differing for combinations of speaker sexual orientation and gender.*

Regarding H3, the interaction effect of speaker sexual orientation and speaker gender was significant as well. Please see Figure 2 for a corresponding depiction (error bars indicate 95% CIs). In line with our expectation, the difference in perceived sexual orientation for lesbian/gay and straight speakers was larger for men than women: While straight men were rated as much straighter compared to gay men ($p < .001$, $\eta_p^2 = .844$), no significant difference of sexual orientation occurred for women ($p = .139$, $\eta_p^2 = .063$). Exploratively, we found contrary gender effects when holding sexual orientation constant. While gay men were perceived as somewhat less straight than lesbians ($p < .001$, $\eta_p^2 = .341$), the opposite was true for straight individuals: Straight men were perceived as much straighter compared to straight women ($p < .001$, $\eta_p^2 = .608$). Correspondingly, sexual orientation of men was rated as more extreme compared to female sexual orientation.

Additionally, we found an interaction effect of speaker gender and topic on an explorative level. For the topic with lesbian/gay reference, men were rated as straighter compared to women ($M_{Men} = 4.59$, $SE = .09$, $M_{Women} = 4.39$, $SE = .09$), $p = .005$, $\eta_p^2 = .212$; no gender difference occurred for the topic where one's own sexual orientation was made salient ($M_{Men} = 4.40$, $SE = .09$, $M_{Women} = 4.42$, $SE = .08$), $p = .860$, $\eta_p^2 = .001$, nor for the topic with no reference to sexual orientation ($M_{Men} = 4.45$, $SE = .10$, $M_{Women} = 4.26$, $SE = .08$), $p = .066$, $\eta_p^2 = .096$. When holding gender constant, we found a difference in perceived sexual orientation for women ($p = .038$, $\eta_p^2 = .180$) and men ($p = .009$, $\eta_p^2 = .246$). Women were rated as straighter for the topic were one's own sexual orientation was mentioned ($M = 4.42$, $SE = .08$) instead of the topic without reference to sexual orientation ($M = 4.26$, $SE = .08$), $p = .035$; no significant differences occurred for the other two topic comparisons, $p > .119$. Men were rated as straighter for the topic with lesbian/gay reference ($M = 4.59$, $SE = .09$) than the topic where one's own sexual orientation was made salient ($M = 4.40$, $SE = .09$), $p = .006$; for the other two topic comparisons, no significant differences occurred, $p > .207$. The three-way interaction of speaker sexual orientation, gender, and topic was not significant.

4. Discussion

The present study explored the question of whether text topic had an influence on the acoustic expression of sexual orientation. Three types of topics were varied, differing in the extent to which they related to sexual orientation. To rule out influences of text type, interview questions were used in all three conditions eliciting spontaneous speech. Although, consistent with previous studies, lesbian/gay speakers were rated as less heterosexual compared to heterosexual speakers [4, 11, 12, 13, 14, 15, 18, 21, 30, 31], contrary to our expectations, this effect was found to be greatest for the condition in which there was no reference to sexual orientation. Moreover, lesbian/gay speakers surprisingly were found to be rated most straight in the condition in which a lesbian/gay reference was made. This contradicts previous studies showing gay men to use more stereotypical speech when expressing opinions on lesbian/gay than straight topics [39]. This points to possible differences in sample composition and the need to collect data on speakers' psychological features such as the extent of being out, number of lesbian/gay friends, or gender-role conformity.

In line with our hypothesis, we found a strong difference of sexual orientation for men (straight men were rated as straighter than gay men) but not women. This is line with previous studies on read speech by Munson et al. [12] and Fasoli et al. [40]; also, descriptive results of Kachel et al. [4] showed the same pattern.

Literature on phonetic convergence suggests that speakers being recorded by same-gender interviewers could have resulted in acoustic alignment [41], enhancing gender typicality of speech. In a study on women varying in sexual orientation [42] it was found that mean fundamental frequency was higher when recordings were done by a female vs. male interviewer. Accordingly, weaker effects could have been expected in mixed-gender settings.

5. Conclusions

The text topic influences how much lesbian/gay and heterosexual speakers differ in the sexual orientation attributed to them by others. This suggests that acoustic differences exist between sexual orientation groups depending on the topic.

6. Acknowledgements

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