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SPECTRUMS: VOCAL PITCH CHARACTERISTICS OF THOSE OUTSIDE THE GENDER BINARY

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ABSTRACT

Vocal pitch characteristics such as fundamental frequency (F0), minimum and maximum frequencies (pitch range), and vowel formant frequencies are influenced by biological, cultural, and sociological factors. Studies have been conducted to look at the perception of transgender voices as well as the efficacy of voice-therapy on transgender people. However, no studies have been conducted looking at those who do not identify as male or female and who identify instead under the "non-binary" umbrella. This study seeks to identify vocal pitch characteristics and spectral characteristics, such as vowel formants, of those who identify as "non-binary" and to observe any differences in these characteristics when compared to female and male identified people. Participants were recruited from the Penn State Brandywine Campus, Penn State University Park, and the Philadelphia queer community. Twenty-one people participated and were recorded reading the Rainbow Passage. Their voice recordings were analyzed using PRAAT for average fundamental frequency (F0), average minimum frequency, average maximum frequency and vowel formants for vowels /i/, /a/, and /u/. Results from the study show there is a main effect of gender on pitch. Those who identified as non-binary patterned in between the cis-female and cis-male groups and they produced pitch statistically significantly differently than those in the female group. Their vowel formants also were roughly in between the vowel formants of those in the other two groups. These findings indicate that those who identify outside the gender binary tend to produce pitch and other vocal characteristics in a way that is neither strictly feminine nor masculine and perhaps includes some influence from both feminine and masculine characteristics.

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Chapter 1

Introduction

Judith Butler (1990), a forerunner in gender theory, emphasizes the idea that gender is a social construct and that in a sense, we perform our gender by our repetitive daily actions whereby we attempt to mimic some ideals of what "man-ness" and "woman-ness" are. This is not to say that we are conscious of this performance or that a mere understanding of this performance means we can easily change our gender or be rid of it entirely. Even though some people might read Butler's work thinking that she dismisses gender entirely, this is not true to Butler's intent. It is a complex relationship of the self and society. It suggests that if the reality of gender is created by its performance, then any gender, or relationship between people of varying genders, is a valid construction. In this light, there are some aspects of gender that people perform more consciously such as how they dress, and then there are subtler aspects to performativity of gender. One such subtler factor is vocal pitch production.

The study of vocal pitch and its relationship to gender is not new. Researchers have been studying to what extent, if there's any influence at all, the gender identity of an individual affects aspects of the pitch of their voice. These studies have not only examined the gender identity itself, but also how sociocultural norms surrounding gender might influence pitch production. The results of these studies have concluded that there is correlation between gender identity, sociocultural norms, and pitch. Comparisons between women in Japan and the Netherlands show that women in Japan produced significantly higher voices than those in the Netherlands,

indicating sociocultural norms of gender impact how high or low someone's voice might be (Van Bezooijen, 1995).

These findings contribute directly to practical linguistic fields such as Speech-Language Pathology. Specifically, as more transgender people are coming out and are able to have access to the psychological and medical support to transition, Speech-Language Pathologists have used this line of research to help treat their clients. Studies have therefore since been done on the effects of voice therapy on transgender people. Consistently, transgender people did show improved self-esteem and reduced gender dysphoria after voice therapy that was geared towards helping them speak more like the desired gender (Carew, Dacakis, & Oates, 2007).

The increased visibility of the transgender community also means there is increased urgency to explore and understand various gender identities and expressions, regardless of what field of research. Linguistics should not be excluded and, in fact, can further enable a better understanding of those with various gender identities. While linguistic studies have been conducted on those who identify as male, female, male-to-female, and female-to-male, there are no comprehensive studies examining the other gender identities in the transgender spectrum which include genderqueer, genderfluid, bigender, agender, gender neutral, etc. For the purpose of this study, we will call the grouping of these other genders "non-binary".

By conducting research on the relationship between pitch and gender with a focus on looking at those who identify as non-binary, this study will aim to bring continued visibility to this community which could have further implications for linguists who seek to answer questions on the information that might be encoded in pitch as well as potentially for Speech-Language Pathologists working with those who are non-binary. Specifically, this study will look at vocal pitch characteristics, including average fundamental frequency (F0), minimum frequency,

maximum frequency, and other vocal characteristics including vowel formants for the vowels /i/, /a/, and /u/, for those who identify as female, male, and non-binary. These vocal pitch characteristics are being examined because in past literature, research has found an effect of gender on them. Vocal pitch characteristics will be analyzed to establish if there are any patterns present in those in the non-binary group that look different than or are unique from the patterns present in the female and male groups. For example, this study will investigate if average F0, minimum and maximum frequencies and vowel formants for those who identify as non-binary pattern in a different way than those who are male and those who are female.

Literature Review

Given the increased visibility and awareness of the transgender community, it is necessary to extend research in the field of linguistics to those identifying under the transgender umbrella. Previous research on pitch and gender has not yet explored non-binary genders and how those identifying as such might use pitch to "encode their gender". Furthermore, many of these previous studies have been on gender perception by other listeners and less on the impact of one's own perception of one's gender on pitch production. In order to understand the context of this study, areas including gender theory, biological factors that impact pitch production, and the research on the relationship between sociological factors and pitch will be reviewed.

Gender and Gender Identity

First, it is important to review some of the current literature on gender and gender identities. One of the most important ideas to grasp about gender theory comes from Judith Butler and her theory of gender performativity. In 1993, Butler wrote on the idea of identity categorization and how it is socially constructed. She claims "identity categories tend to be

instruments of regulatory regimes, whether as the normalizing categories of oppressive structures or as the rallying points for a liberatory contestation of that very oppression." (308). That is to say that those who construct gender identities are either the oppressive regimes or the minority pushing back against the categorization by developing its own categorization. Butler also challenges the idea of sex and gender being tied together and suggests that gender is not a binary. (Butler, 2011). Gender theory is not the only field that has told us that gender is more complicated than simply how we are born. For example, in psychological science, Egan and Perry (2001) conducted a large self-report study with 182 children looking at a wide variety of concepts involved in gender identity including global self-worth, self-perceived peer social competence, gender compatibility, felt pressure, intergroup bias, male-typed activities, female-typed activities, acceptance from male peers, and acceptance from female peers. The authors found that "gender identity is multidimensional" meaning that one's perception of their gender is not decided by one factor such as a particular masculine or feminine trait, but rather that one's perception of their own gender is influenced by a combination of factors. They also concluded that by middle childhood children develop relatively concrete ideas about their gender identity.

Alexander Yoo (2015) extends this line of thinking to transgender and gender diverse children and adolescents. He eloquently explains that transgender and gender diverse children and adolescents of any age and their gender expression and identity develop by a similar age, concluding that children gain a sense of gender as a concept usually by the age of one and that as early as the age of two, a child can begin to express their gender. However, he notes that the age in manifesting one's desired gender varies and that regardless of the age when a child or adult begins to realize or express their gender, their gender is still just as valid and an older age of

realization does not make the person's gender identity "less real" than those who experience a younger realization (Yoo, 2015).

Effects of Biology and Biological Sex on Pitch

It is well known in the literature that biology affects vocal pitch production. Aspects such as height/weight, hormones, and vocal tract characteristics can contribute to differences in pitch production. For example, in terms of height and weight, babies are smaller and have a high fundamental frequency (around 500 Hz). As we grow, our voices change. This is also due to the influence of hormones; for instance, testosterone causes the lowering of a male's voice during and after puberty. Finally, one biological characteristic that accounts for much of the difference in pitch between adult females and adult males is vocal fold length. Males, on average, have a vocal fold length 60% longer than that of females which causes their voices to be generally lower than that of females (The National Center for Voice and Speech, n.d.).

Average fundamental frequencies and pitch ranges have been established for adult cis-males and cis-females (Davies & Goldberg, 2006), emphasizing that biological differences have an influence on pitch. Female/feminine norms for pitch include a mean pitch of 196-224 Hz, with an average range from a minimum of 145 Hz to a maximum of 275 Hz. Male/masculine norms for pitch include a mean of 107-132 Hz and an average range from a minimum of 80 Hz to a maximum to 165 Hz. It is also noted that the formant frequencies for vowels tend to be higher for female/feminine voices and lower for male/masculine voices. This shows an effect of biological sex on pitch. However, biology is not the only determining factor in pitch production.

Sociological Factors and Pitch

Sociological factors in respect to gender norms and gender roles also play an important role in pitch production. Bezooijen (1995) explores the relationship between pitch, gender, and sociocultural norms in her paper "Sociocultural Aspects of Pitch Differences between Japanese and Dutch Women". Her experiment included 8 English speaking women and 8 Dutch speaking women. These women were "cis-gender", meaning that they identified with the gender assigned to them at birth, and therefore, are not part of the transgender community. Her conclusion is that the Japanese women produced significantly higher pitch than the Dutch women and that the Japanese women found higher voices were more desired for women in their society; therefore it was concluded that the preferred pitch for women is relatively high in Japan and relatively lower in the Netherlands. This study shows that sociological and cultural ideas of gender impact how people view their gender and as a consequence, impacts certain qualities of their pitch.

As research slowly started to include various minority groups, other studies with cis-women and cis-men were conducted, now looking to see if there was any correlation between pitch, gender, and sexuality. Baeck, et al. (2011) looked at 140 men, only 30 being homosexual and found that gay male speakers do, on average use a higher fundamental frequency than heterosexual males and that they also have more variation in their pitch. Despite finding a statistical difference, the authors note that the average difference between the gay men and heterosexual men was less than 10 Hz, that the gay men still spoke significantly lower than heterosexual females, and that 93% of their gay male participants fell within the norms established for male speakers. Thus, the authors clarify that their results "do not confirm that the stereotype that gay male speech mirrors the patterns of women's speech with respect to pitch characteristics" (214). This is important because it shows that pitch characteristics might not be

affected as strongly by someone's sexuality as it is by gender identity, and this was also found in a study by Borsel et al. (2013). Borsel et al. looked at 102 women, only 34 being self-identified lesbians. The results of this study were strikingly similar to the 2011 study on homosexual men: lesbian women on average demonstrate a lower average pitch and less pitch variation than heterosexual women; however, there is no categorical difference between the homosexual and heterosexual women. Regarding these two studies, it cannot be concluded that sexuality or sexual orientation has a definitive impact on pitch production.

Therefore, while the LGBTQ community might not be new to the field of linguistics, there is still a lack of transgender related research. Current literature on transgender people and linguistics come primarily from a perception standpoint – i.e. how well are transgender people perceived by others as the gender they identify with? Carew et al. (2007) as well as McNeill et al. (2008) both looked at MTF (male-to-female) voice therapy clients, but each of them taking two different approaches. Carew et al. (2007) examined how spreading the lips wider and bringing the tongue more forward when speaking can have a positive effect on increasing the fundamental frequency and vowel formant frequencies, both of which are female voice characteristics. Therefore, this showed that the physiological adjustment can help with those transitioning to obtain the voice they want. McNeill et al. (2008) studied something very different – whether or not a person's happiness with their gender correlates with fundamental frequency. Interestingly, McNeill et al. found that fundamental frequency itself does not correlate with happiness of voice – that is the person's satisfaction with the sound of their own voice, but that other aspects of voice may be important for conveying their gender stating that change in formant patterns influence judgement of gender.

A more recent study by Hancock et al. (2014) also examined the perception of gender through voice. The conclusions of this study which included both MTF (male-to-female) and FTM (female-to-male) participants found that intonation has potential for use in transgender voice therapy as it does seem to influence perception and that while intonation in itself is not a definite indicator of gender, speaking with more downward intonation might help to distinguish speakers as male. More recent studies such as one by Hardy et al. (2016) looked at MTF speakers before they transitioned (i.e., had not undergone any hormone therapy or voice therapy). This study found that while only two of the speakers were perceived as female, the speakers generally showed a higher F2 value for /a/ which correlates with a more feminine voice and also which notably, the listeners found more natural. Finally, a study conducted in 2016 by Munson et al. looked at F1 and F2 of vowels, fundamental frequency, vowel duration, and the first 3 spectral moments of /s/. The authors found that boys with Gender Identity Disorder (GID) sound less prototypically masculine than boys without GID and it is noted that these differences were much larger in sentence production than in single word production.

Summary

In summary, many researchers have explored the relationship between pitch and gender with the majority focusing on average fundamental frequency (F0) and perception tasks. The most recent study by Munson et al. (2016) looks at much more than just F0, such as vowel formants and spectral moments and notes that these differences are more observable in sentence production than in single-word production. Therefore, this study will include average F0, minimum and maximum frequencies, and vowel formants and these will be analyzed in sentence production. Additionally, this study will take a more analytical approach focusing on the

production of pitch in relationship to the self-identity of gender, recognizing that gender exists on a spectrum. Finally, none of the current studies on gender and pitch shed any light on non-binary voices. Thus, this study will seek to describe the vocal pitch characteristics of those who identify as non-binary.

Hypotheses

It is hypothesized that because those who identify as non-binary reject male and female identities, the non-binary group will pattern relatively in the middle of the female and male groups for average F0, minimum and maximum frequencies, and for vowel formant frequencies. That is, it is predicted that the non-binary participants will have a greater average pitch, minimum pitch and maximum pitch as well as higher vowel formants than the male group, and that they will have a lower average pitch, minimum pitch, and maximum pitch as well as lower vowel formants than the female group. This is predicted for two possible reasons. The first possibility is that non-binary group consists of identities that include elements of masculinity and femininity and thus, they will mix together elements of gender performance from each, which puts them in the middle of the males, who skew masculine, and the females, who skew feminine. Another possibility for the prediction that the non-binary group will trend in the middle of the male and female group is that the non-binary voices combine influences from biology and anatomy and socialized gender performance.

Chapter 2

Methods

Participants

This study recruited participants who identify as male, female, and non-binary. Those identifying as male or female could identify as cisgender or transgender. They were recruited by emails, social media and word-of-mouth, and specific clubs and venues were utilized such as the LGBTQ clubs on campus and in the area. Their participation was confidential and no identifying information was collected.

Twenty-one individuals volunteered to participate in the study. Of these, nine were cis-female, six were non-binary, five were cis-male and one was trans-female. For descriptive purposes, all participants were considered; however, for inferential statistics, the trans-female was excluded as we could not make generalizations about this group at large due to the small sample (n=1). All participants were over the age of 18, but specific ages were not collected. All participants considered English to be their native language. These participants came from the Penn State Brandywine student community, the Penn State University Park campus, and the Philadelphia queer community.

Materials and Procedures

Those that agree to participate were asked to read the “Rainbow passage” which is used by Speech-Language Pathologists and linguists to examine accent and pitch characteristics (Fairbanks, 1969).

> "When the sunlight strikes raindrops in the air, they act like a prism and form a rainbow. The rainbow is a division of white light into many beautiful colors. These take the shape of a long round arch, with its path high above, and its two ends apparently beyond the horizon. There is, according to legend, a boiling pot of gold at one end. People look but no one ever finds it. When a man looks for something beyond his reach, his friends say he is looking for the pot of gold at the end of the rainbow."

Participants were recorded speaking into a microphone and using the software PRAAT on a laptop. Whenever possible, they were recorded in a quiet room or office with minimal background noise. Their speech recordings were saved as WAV files for analysis. After they finished reading the passage, they were asked to complete a survey that has been developed via Qualtrics that included questions about their native language and aspects of their gender including identity, expression, experience with hormone therapy, experience with voice therapy and experience with psychological therapy in regards to their gender (see Appendix A).

Analysis of speech recordings were done through PRAAT to examine average F0, max frequency, min frequency, and vowel formants for vowels /i/, /a/ and /u/. Each of the six sentences in the passage were analyzed for their average F0, minimum and maximum frequencies. Then, an average for the passage F0, minimum and maximum frequencies were calculated by averaging the sentence F0, minimum and maximum frequencies together. Three instances in three unique tokens in the paragraph were used to create average vowel formants for the vowels /a/ and /i/. For the vowel /u/, only two unique instances were used. For statistical analysis, SPSS (IBM Corp., 2013) was used as well as R (R Core Team, 2013).

Chapter 3

Results

Survey Results

Results from the survey are presented in Table 1. for descriptive statistics including the questions on female and male characteristics (identity) and presentation. The first two columns represent the questions about the participant's female characteristics in general and "today" (the day they took the survey), respectively. The next two columns represent the same, but for the participant's male characteristics. The last two columns represent the questions about feminine and masculine presentation (expression). These were all on a scale of 0-100. The cis-female and non-binary groups both presented considerably more variability in both characteristics and presentation than the cis-male group. In general, the cis-male group did not indicate any strong feeling of female characteristics or feminine presentation, though the group was more conservative in their presentation than their characteristics.

For the last three questions corresponding to psychological, hormonal, and voice therapy in regards to gender, all of the cis-male participants indicated they had never received any of these therapies and all but one of the cis-female participants indicated they had never received any of these therapies. The one cis-female participant who did not indicate "No" for all three therapies indicated that she is currently receiving psychological therapy in regards to her gender identity, but has not received hormonal or voice therapy. Half of all non-binary participants indicated they had received psychological therapy in regards to their gender identity in the past, but not currently. Two of the non-binary participants indicated that they are currently receiving hormonal therapy in regards to their gender and one indicated that they have received hormonal therapy in the past, but are not currently receiving it. Out of all the participants, only the trans-

female participant indicated receiving voice therapy, but this was in the past she is not currently receiving voice therapy.

Table 1.
Descriptive Statistics for Survey Results on a scale of 0-100. Means are noted with standard deviations in parentheses.

Group	**Fem. Char. Gen.**	**Fem. Char. Today**	**Mal. Char. Gen.**	**Mal. Char. Today**	**Fem. Pres.**	**Masc. Pres.**
Cis-Female (n=9)	77.22 (26.20)	76.00 (27.94)	27.11 (30.49)	24.44 (28.82)	60.89 (31.90)	40.33 (33.12)
Cis-Male (n=5)	10.80 (14.94)	12.60 (13.56)	89.60 (14.31)	87.80 (12.83)	3.00 (4.47)	84.00 (26.01)
Non-Binary (n=6)	38.83 (27.47)	37.17 (25.68)	34.67 (29.98)	24.33 (27.20)	45.67 (25.37)	56.00 (37.14)
Trans-Female (n=1)	60	60	20	20	0	60

Average Fundamental, Minimum, and Maximum Frequencies

Descriptive statistics for each of the groups for average fundamental frequency (F0) are shown in Table 2. Differences were observed between the groups for F0. The cis-female group presented the highest average pitch and the cis-male group presented the lowest average pitch which was expected given past research and the norms established for adult males and females. The non-binary group was in the middle of these two groups, higher than the cis-male group, but not as high as the cis-female group. Additionally, the trans-female speaker had an average pitch higher than that of both the cis-male and non-binary groups. The one way analysis of variance (ANOVA) for F0 showed a main effect of gender on pitch, $F(2, 17) = 30.25$, $p < .001$. Because

there was not homogeneity of variance, a Welch correction to the ANOVA was used and also showed a significant difference between groups, $p < .001$. A multiple comparisons test using the least significant difference (LSD) found that the cis-female group was statistically significantly different from the other two groups; however, the non-binary and cis-male group were not found to be statistically significantly different although it is trending in that direction, $p = .051$.

Table 2.
Means and Standard Deviations for Average Fundamental Frequency

Gender Identity	*M*	*SD*
Cis-Female	202.85	12.79
Cis-Male	117.83	14.75
Non-Binary	144.43	32.49
Trans-Female	159.28	-

Descriptive statistics were also done for average minimum and average maximum frequency to show a range for each group (see Figure 1). The non-binary group had the largest range with the lowest average minimum frequency and the highest average maximum frequency. The ANOVA for average minimum frequency also showed a main effect of gender, $F(2, 17) = 9.55$, $p = .002$. The minimum frequencies had homogeneity of variance and therefore, a Welch correction was not necessary. A multiple comparisons test using the LSD showed a statistically significant difference between the cis-female group and the non-binary group, $p = .001$, and a statistically significant difference between the cis-female group and cis-male group, $p = .005$. There was no statistically significant difference of minimum pitch between the non-binary and cis-male groups. The ANOVA for average maximum frequency and the ANOVA for average range did not show statistically significant differences between any of the groups.

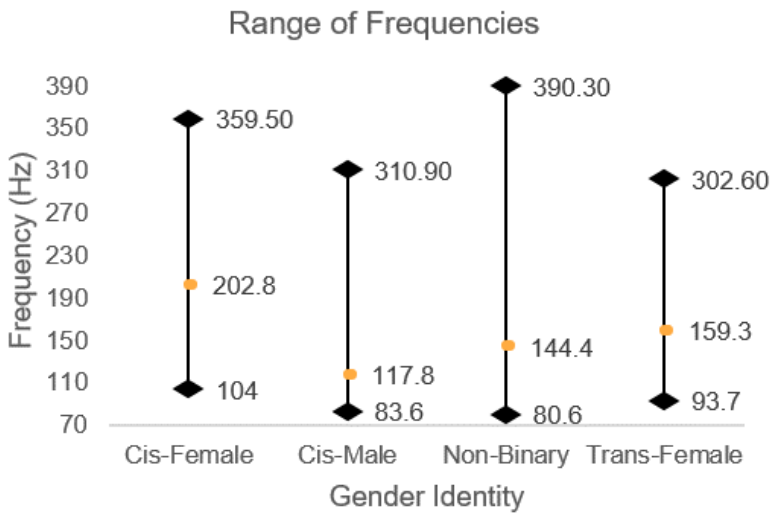

Figure 1. Average minimum to average maximum frequency by gender identity.

Vowel Formants

First, second and third formants were analyzed for the vowels /i/, /a/ and /u/. Three instances of the vowel /i/, three instances of the vowel /a/ and two instances of the vowel /u/ were analyzed to create average vowel formants (F1, F2, and F3) for each individual and then each group. A vowel plot was created using F1 and F2 in PRAAT (see Figure 2). The cis-female group showed the highest F1 and F2 for each of the vowels and the cis-male group showed the lowest F1 and F2 for each of the vowels, as expected. The non-binary group fell generally in the middle of these frequencies for F1 and F2 except for /u/.

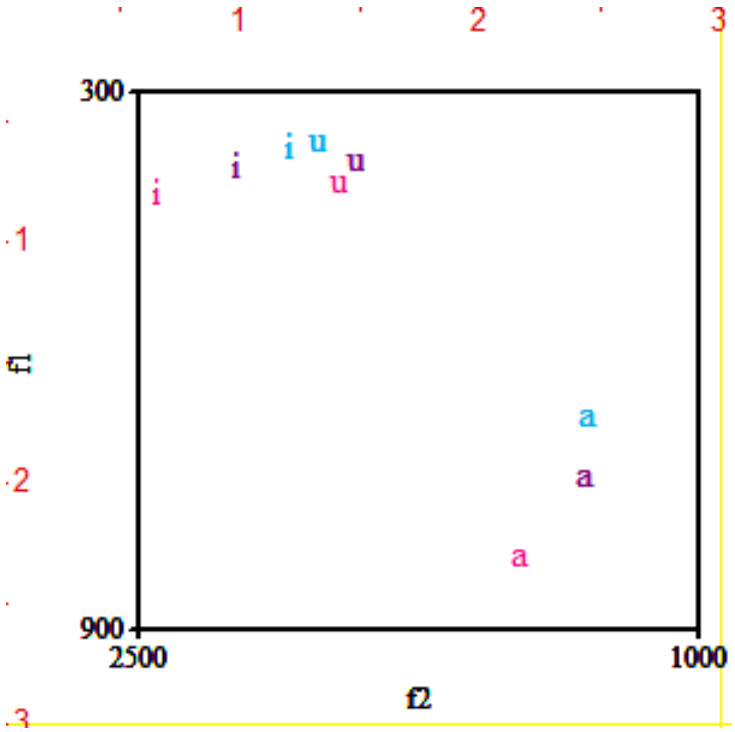

Figure 2. Vowel chart for vowels /i/, /a/ and /u/. Pink = cis-female group, blue = cis-male group, and purple = non-binary group.

Chapter 4

Discussion and Conclusions

The non-binary group performed pitch significantly differently from the cis-female group with an average F0 of nearly 60 Hz less than that of the cis-female group. While not statistically significantly different from the cis-male group, the non-binary group did have, on average, an F0 of 30 Hz higher than the cis-male group. For both this fundamental frequency and the first two vowel formant frequencies for vowels /i/ and /a/, the non-binary group was about in the middle of the cis-female and cis-male group. For minimum frequency, the non-binary group had the lowest average minimum frequency and the highest average maximum frequency which shows that they had a greater range of frequencies than the cis-female group and the cis-male group.

The results for average pitch and vowel formants are in line with what was hypothesized. Those who identify as non-binary did not pattern like cis-females nor did they pattern like cis-males. Instead, they patterned roughly in the middle, higher than the cis-males for average pitch and vowel formants, and lower than the cis-females for average pitch and vowel formants, indicating either a mix of feminine and masculine vocal characteristics or a neutrality – a rejection – of both. However, the non-binary group was unique in another way than hypothesized in that the average minimum pitch was lower than both the cis-female and cis-male groups and that the average maximum pitch was higher than the other two groups. While we cannot make any grand conclusions from that fact alone, especially as there was no significant statistical difference between group for range, it could be interpreted that the non-binary group are more comfortable producing a larger range of pitch because they do not adhere strictly to the

categories of “female” or “male”. Knowing these results, this could shed light onto the field of speech-language pathology and voice therapy. Because voice therapy is common for transgender people who are looking to sound more like the gender they identify as, the same could be true for those who identify as non-binary especially as more people begin “coming out” in this way. Additionally, these results help to lay the groundwork for future linguistic studies that seek to identify vocal pitch characteristics of those who identify under a wide range of gender identities.

The results of this study, while interesting, should not be taken as generalizations for all those who identify as non-binary. Even within this study, our non-binary participants described their gender identities in various ways with three of them identifying as agender, two of them identifying as genderqueer, and one of them identifying as genderfluid. It might be that while all of these identities fall under “non-binary” they do not all behave similarly which is consistent with the large variability we saw with our non-binary group.

While differences were seen between the cis-female and cis-male group for average F0, the average difference was only 80 Hz. This is detectable in speech, but in the grand scheme of pitch, this is not a tremendous difference. Therefore, for the non-binary group, which fell in the middle of the cis-female and cis-male group, to be statistically significantly different from both of the other two groups would be difficult. It might be that if this study were repeated with many more participants especially for the non-binary group, we might see less variance and more statistical significance in differences.

Another consideration is that these results might look different in cultures where gender roles are more strict, such as Japanese society where women have a much higher pitch because of these gender norms. It could be hypothesized that if men and women differ more greatly in such societies, perhaps those who are non-binary would as well.

Appendix A Survey

The first question of the survey asked participants for their native language which was an open response field. The rest of the questions were focused on their gender identity and included the following questions:

"Which of the following best describes your gender identity?", Choices included: Female (cis), Female (trans), Male (cis), Male (trans), Genderqueer, Genderfluid, Agender, Other (with a space to write in whatever the participant felt aligned with their identity).

"Which biological sex were you assigned at birth?" Choices included: Female, Male, and Intersex.

"On a scale of 0 to 100, how much do you identify with female characteristics IN GENERAL? (This is self-identity and not expression)" This was a sliding scale from 0 to 100 with 0 = no female characteristics and 100 = all female characteristics.

"On a scale of 0 to 100, how much do you identify with male characteristics IN GENERAL? (This is self-identity and not expression)" This was a sliding scale from 0 to 100 with 0 = no identification with male characteristics and 100 = entire identification male characteristics.

"On a scale of 0 to 100, how much do you identify with female characteristics TODAY? (This is self-identity and not expression)" This was a sliding scale from 0 to 100 with 0 = no female characteristics and 100 = all female characteristics.

"On a scale of 0 to 100, how much do you identify with male characteristics TODAY? (This is self-identity and not expression)" This was a sliding scale from 0 to 100 with 0 = no identification with male characteristics and 100 = entire identification male characteristics.

"On a scale of 0 to 100, to what degree do you normally present or dress femininely?" This was a sliding scale from 0 to 100 with 0 = do not present or dress femininely at all and 100 = present or dress entirely femininely.

"On a scale of 0 to 100, to what degree do you normally present or dress masculinely?" This was a sliding scale from 0 to 100 with 0 = do not present or dress masculinely at all and 100 = present or dress entirely masculinely.

"Have you ever received psychological therapy in regards to your gender identity?" Choices included: Yes, currently; Yes, in the past but not now; and No.

"Have you ever received hormonal therapy in regards to your gender identity?" Choices included: Yes, currently; Yes, in the past but not now; and No.

"Have you ever received voice therapy in regards to your gender identity?" Choices included: Yes, currently; Yes, in the past but not now; and No.

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