

Project POV: A Palette of Voices for Transmasculine Individuals

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Dedications

This thesis is dedicated to the trans community of the Twin Cities. You are so full of beauty and light. I have never felt so proud to be a part of something.

Abstract

The growing practice of gender-affirming voice in Speech-Language Pathology often overlooks the voices of transmasculine people. Previous research in this topic focuses primarily on obtaining acoustic information that will help trans folks assimilate to cis-sounding voices. We developed a corpus of voices from masculine-identifying people and designed an experiment to gather perceptual data on the voices, followed by a qualitative interview process with a group of transmasculine people local to the Twin Cities. Our findings indicate greater acceptance of voice types from gender expansive participants compared to cisgender, heterosexual participants. Transmasculine participants also indicated vastly varied desirable acoustic qualities in voices. The interview process showed that there is a significant need for qualitative data when conducting research on trans voices – as the vocal needs of the community are diverse – and there is a lack of information regarding voice changes on Hormone Replacement Therapy felt by the community.

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Introduction

Positionality Statement

In my own experiences as a trans man, I faced a lot of uncertainty and turmoil around my decision to go on HRT. I have always had a close relationship to my voice, and though I knew the voice I had wasn't quite what I wanted, I was still terrified to lose it. As the only trans person in my music school in rural Indiana, I had no one to tell me what I could expect, or whether I would ever be able to sing again. I had no idea if T would be worth it, and I could not find any information, research, advice, or comfort anywhere. I've been on T now for 4.5 years, and I've been working on my voice ever since. Because of my experiences, I designed a research project meant to center and uplift transmasculine people, a population often neglected by the medical field and speech-language-hearing sciences. With that said, I acknowledge that my personal experiences as an 'insider' of the studied group can result in research biases, and my participation in Queer communities within the Twin Cities places me in a unique position to perform research on people to whom I am connected. My identity as a white, educated, 25-year-old man also influences my work and, as a result, this project does not encompass the experiences of all transmasculine people.

Gender (and Gender-Affirmation) and Speech

There are many different ways to be a man, a woman, both, neither, or something else entirely. The gender that we communicate to the world, known as gender presentation, is a careful construction of many factors: clothes, shoes, socks, colors, hairstyle, smells, makeup, body hair, jewelry or lack thereof, accessories, fingernails, bumps in various but meaningful parts of the body, speech patterns, and voice. We take our perceptions of all these items combined and decide in an instant what gender our communication partner is, then base

decisions about how we treat that person on the assumption that we made (Zimman, 2015). This is how many human societies, including US society, are organized: one is put into the neat category of *Man* or *Woman*, and from the moment one are born, one belongs to this category and is expected to adhere to the benefits and limitations one receives from it (World Health Organization, n.d.).

As long as these two categories have existed, there have been those who dare to defy them. There are many ways to do so, and these ways have created their own separate categories whose names have changed and developed through the years. Drag queens, crossdressers, transsexuals, transvestites, butches, femmes, trans people, non-binary people, and gender non-conforming people all have one thing in common: they have rejected society's norms on what they are supposed to look like based on the body they are born into (Kang et al., 2017). Western culture has its own unique view of gender nonconforming people both socially and medically, while other cultures have different ideas of what it means to be somewhere outside the male and female binary, for example, Hijra and Kothi people in India or Kathoey in Thailand (Stief, 2017; Vasey & VanderLaan, 2008).

The academic fields that study speech and language (including Speech-Language-Hearing Sciences, Speech-Language Pathology, Audiology, Linguistics, and Psychology, among others) have primarily studied behaviors that are ostensibly *shared* across individuals in a language community, like vocabulary and syntax. One reason for this is the focus on the 'ideal speaker-hearer' in developing models of language knowledge, as has been done in the generative linguistics research tradition (Chomsky, 1965). In this tradition, the goal of language studies was to characterize language as an abstract set of principles, rather than how it is used by individuals and in communities. Hence, relatively little consideration has been given to the behaviors that are

by definition not shared by a language community, including the speech and language behaviors that convey identities (Tripp & Munson, 2022).

The focus of this thesis is on one aspect of how speech conveys identity: the ways that individuals' masculinity are conveyed and perceived through phonetic variation. This work construes masculinity broadly, and hence includes both cisgender and transgender individuals, and both men and transmasculine nonbinary individuals. This work builds upon a relatively young research literature in the field of Speech-Language-Hearing Sciences on gender and speech. Much of this work has focused on whether listeners can identify if a person is male or female based solely on the way they speak, as opposed to what they are saying. This work is reviewed and critiqued in Babel and Munson (2014), Munson and Babel (2019), and Tripp and Munson (2022). Studies have shown that people can indeed identify people as male or female from very short stretches of content-neutral speech, like consonants, vowels, words, and longer stretches (Bacharowski & Owren, 1999; Lass et al., 1976; Munson et al., 2006). One hypothesis is that these differences are due entirely to sex dimorphism in vocal folds and vocal tracts between cisgender men and women. Recent work has shown persuasively that sex dimorphism is not the sole cause of gendered speech. Gender differences can be seen in children prior to the onset of sex dimorphism at puberty (Fung et al., 2021; Munson et al., 2022; Perry et al., 2001). The magnitude of gender differences varies across languages (Johnson, 2006) and across different ages, social classes, and racial identities within languages (Calder & King, 2020; Stuart-Smith, 2007). These findings and others suggest that gendered speech is *constructed* as an act of *social agency*, and not merely the passive consequence of a sex-dimorphic speech-production mechanism.

Research on the perception of sexuality through speech has followed a similar path. Studies have shown that men and women's sexual orientation can be identified at greater-than-chance levels from phonetic variation alone (Mack, 2010; Munson et al., 2006; Smyth et al., 2003; Tracy et al., 2015), whereas studies of the perception of sexual orientation and gender have shown that a variety of cues predict ratings. These include measures that characterize spans of sounds and words (like mean fundamental frequency [f0], variation in f0, average formant frequencies), and specific phonemes (like distinctive pronunciations of vowels like /æ/ and /u/ and consonants like /s/). Again, these differences do not suggest that sexuality is associated with differently configured vocal tracts, but that people learn socially and linguistically specific ways of conveying sexuality through phonetic variation (Munson, 2010).

These findings have been published around the same time that speech-language pathology has created a new field of services: *gender-affirming voice therapy*. This practice goes by various names, including *gender-affirming communication services* and *gender-expansive voice therapy*, among others. We use gender-affirming voice therapy in this paper not to exclude practices that are provided under those other labels, but to be consistent. Though the term we use contains the word 'voice', this paper does not limit its discussion to topics that are traditionally subsumed by the term *voice therapy*, like f0 and voice quality. In gender-affirming voice therapy, clients under the gender non-conforming umbrella learn how to modify their voices to more closely align with the gender they want to present as, including modification of language choice, articulation, intonational variation, and social pragmatics. In short, the field of SLP has taken the question, "what does it mean to sound like a man or woman?" and used acoustic and linguistic information obtained from largely cisheteronormative research as the basis for creating strategies to emulate those qualities.

This practice can help people who are seeking to present in ways that align with the gender binary, but it is susceptible to a number of pitfalls. As described in Huff (2022), the practice of voice modification both in a gender-affirming voice context and in traditional voice rehabilitation has been primarily developed and performed by cisgender SLPs. Clinically consistent ear training for clinicians and a framework for educating people to perceive and facilitate factors other than f0 are missing. Considering the limitations of currently available options for surgical intervention, these pitfalls are detrimental to the success of clients' voice modification (Huff, 2022).

Another blind spot in this practice is failing to realize the narrowness of the research that has been used to define what it means to sound male or female. For example, studies like Hillenbrand et al. (1995) are often used as normative values for vowel production by men and women. The participants in that study were from the Upper Midwestern US and were pre-screened to ensure that they produced vowel distinctions (like /ɑ/-/ɔ/) that met prescriptive standards for English pronunciation. Their racial identity was not reported, and the speech materials consisted of single words. Such norms do not reflect (in the case of Hillenbrand et al., by design) the diversity of ways of speaking and ways of being.

Moreover, the very construct of gender is about *social agency*: exercising control of how the world sees you, and using your identity to find community with people who think like you (Zimman, 2016). The medical model of standardized assessments (often referencing norms like Hillenbrand et al.) and treatment plans tend to create a space where people are told what is normal. There is little SLHS research on gender as it exists beyond those who identify with their sex assigned at birth, though there are notable exceptions in recent works (Houle & Levi, 2020, 2021; Holmberg et al., 2023; Merritt, 2020, 2023; Merritt & Bent, 2020, 2022). Those exceptions

aside, the field of SLHS and the practice of speech-language pathology actively participate in promulgating the notion that human voice is exclusively sexually dimorphic.

Due to the newness of societal attention on gender deconstruction, and the growing acceptance of gender non-conforming folks (Parker, 2022), conversations about gender and the voice center around how to *assimilate*: how to make trans women sound more like cis women and trans men sound more like cis men (Chang & Yung, 2021). This assimilation often presumes that the desired ways of speaking are the white, monolingual English-speaking, heterosexual ways of speaking that dominate research studies. Largely, any research that includes trans people is executed and published by cis people speaking about trans experiences, rather than trans people conducting and discussing research on our own community (Huff, 2022).

Breaking these patterns entrenched in the SLP field is a difficult task which requires massive change on many societal levels. One starting point could be larger numbers of trans people in the field researching, practicing speech pathology, and sharing their experiences. The inaccessibility of acquiring a master's in speech pathology—which has an average cost of nearly \$100,000 for in-state students at the author's public institution—alone is a barrier, and especially so to members of an already disenfranchised community. Fighting against the current full-fledged moral panic about gender affirmation (Yurcaba, 2023) requires more representation of different experiences of gender in books, movies, TV shows, social media, and otherwise in the public eye, in addition to social freedom to explore gender without consequence, which is especially difficult in the social and political climate as of the writing of this thesis, in which lawmakers actively fight against social freedom with bans on healthcare, drag performances, youth sports, books, and bathrooms (American Civil Liberties Union, 2023). Practicing speech pathologists who honor the struggles and joys of being gender non-conforming can begin to

break apart cisheteronormative expectations for their clients by providing accessible and reliable education to trans folks on the anatomy and physiology of our own voices so that we can feel empowered to make adjustments without fear of injury. One way to encourage this practice is to create clinical tools for SLPs to use which elevate different ways of speaking—both inside and outside the cisnormativity boundaries—as worthy and desirable. It is the arguments in this paragraph that motivated the design and execution of the scholarship described in the remainder of this document.

Transmasculinity and Speech

Most existing research about trans voices is centered on transgender women (Leyns et al., 2022, 2023; Thornton, 2008; Dahl & Mahler, 2020; Kim, 2020). The focus on masculinity (including transmasculinity) requires an understanding of the unique issues faced by folks in this population, which are typically distinct from those faced by transfeminine people. In the first round of testosterone-dominant puberty by a child assigned male at birth (AMAB) – for example, a cisgender boy experiencing vocal changes as a teenager – the vocal folds gain mass, the vocal tract lengthens, and the larynx drops (Harries et al., 1998). Once these changes have occurred, they are irreversible with pharmacological treatments like hormone replacement therapy (HRT) that transfeminine people can take to facilitate other aspects of their transition. Hence, a trans woman who experienced a testosterone-dominant puberty as a teenager cannot undo vocal fold thickening and larynx lowering via HRT (Gelfer, 1999) Rather, if she wants to change her voice, she must rely on behavior modification – perhaps in combination with surgery – to physically alter her vocal folds. Such behavior modification typically includes raising her fundamental frequency, ‘brightening’ her resonance - a clinical term used to describe raising the larynx and advancing the tongue root during speaking (Dorman, 2017) - speaking with more

intonational contrast, and hyperarticulating distinctions among vowels and consonants (Mills & Stoneham, 2017). The practice of gender-affirming voice therapy is designed to aid trans women in this exploration and reformation of vocal habits and speaking voice while remaining vocally healthy. A client might attend 2-8 voice therapy sessions to learn about the anatomy and physiology of the voice, learn how to move her muscles to create different sounds, and develop a practice routine to generalize her new voice once she has developed one that meets her therapy goals. If voice therapy is not sufficient for her to achieve her ideal voice, a few different types of phonosurgeries are available to those with health insurance who live in or can travel to a place where doctors are willing and able to perform these procedures, provided they have space on their lengthy wait lists (Warner & Mehta, 2021). Vocal fold surgeries may involve shortening the length of the vocal folds, removing mass from the vocal folds, or tensing the vocal folds. These procedures will address f_0 of the patient's voice but are best utilized in conjunction with voice therapy to address other aspects of speech feminization (Dwyer et al., 2023).

Transmasculine people, however, *do* experience voice changes on HRT. Someone who was assigned female at birth (AFAB) and who begins HRT after an estrogen-dominant puberty as a teenager will undergo some of the same vocal effects that a first-round testosterone-dominant puberty provides. The effects of testosterone (henceforth *T*) on the voice are only beginning to be understood (Azul et al., 2017; Groll et al., 2022). Limited research on the effects of *T* on the voice has shown that *T* results in a decrease in the person's f_0 , though not always to that of the average cisgender male voice (Groll et al., 2022, Ziegler et al., 2018). Beyond this, the effects of *T* are not well documented. Other changes such as vocal tract length and the height of the larynx may be detectable in acoustic analysis (Groll et al., 2022; Cler et al., 2020). As such, lower f_0 is typically achieved by *T* without behavioral modification. Some transmasculine

people are satisfied by this physiological change alone, and likely will not seek out additional support. However, many transmasculine individuals who have taken T do seek out additional support for voice modification (Ziegler et al., 2018). Providers and researchers have spent more time and resources dedicated to the voices of trans women than trans men due to the physiological advantage that T provides, which is not a benefit offered by transfeminine hormone treatments. While more attention is needed on trans healthcare as a whole, this experiment was designed with the intention of filling in research gaps specifically excluding transmasculine people.

Re-Centering Discourse: Gender in Speech as Social Agency

The literature on gender and speech in speech-language pathology has not yet embraced gender as it is understood in gender studies and in many sectors of society as an act of social agency. Trans people create their own identities through resistance to normative structures – including linguistic self-identification, as described in Zimman (2019). To introduce agency into speech-language pathology, we must first acknowledge gender as agency by understanding that the act of self-creation inherently rejects the binary nature of male vs. female. We must also build clinical tools that can be used to facilitate conversations about agency and speech, rather than a prescriptive, one-size-fits-all approach that is only designed to help trans folks sound ‘more male’ or ‘more female.’ Beyond this, the intersection of voice and identity beyond gender must be considered: sexuality, race, socioeconomic status, and other identities may play a role in linguistic agency as well.

The normative data currently available on gender and speech is based overwhelmingly on cisgender men and women, as described above. The homogeneity of speech-language pathology as a profession (A Demographic Snapshot of SLPs, 2019) means that clinicians cannot be

expected to represent a range of genders themselves. As such, speech samples that represent a variety of ways of sounding masculine are necessary to incorporate into their practice. These should be accompanied by thorough acoustic description, so that clinicians have references for the attributes that a client identifies as desirable. Such a tool would also benefit from being perceptually rated by a diverse group of individuals, so that clinicians and clients have a reference for the social meanings that their desired qualities convey. The latter task is well within the scope of existing research in speech-language pathology and speech-language-hearing science: there is an established tradition of examining the social meanings that speech conveys (Welch et al., 2021; Welch & Helou, 2021).

Research Objectives

With these issues in mind, the activity described in this thesis was developed. The broad goal of this work is to improve our scientific understanding of transmasculine speech, and to improve clinical services for transmasculine individuals seeking gender-affirming voice therapy. This work is highly formative, and hence we list research *objectives* rather than research questions. The four objectives of this work are:

1. To record a corpus of speech by a diverse set of masculine-identifying individuals, including cisgender men, transmasculine men, and transmasculine non-binary people.
2. To characterize the corpus in acoustic-phonetic dimensions that could potentially be targeted in gender-affirming voice services.
3. To collect a set of ratings from a diverse community sample that intentionally includes a large set of people who are not heterosexual and cisgender.

4. To collect the same set of ratings from a group of transmasculine people, along with personal narratives that contextualize these ratings in the person's lived experience as a transmasculine person.

The hoped-for result of this work is to bring transmasculine people into the ongoing conversation of how to provide gender-affirming voice therapy – to discuss needs with the community directly and begin working on a useful tool for therapy sessions and for transmasculine folks at large. Other useful results could be a small sample of information on identifying qualities of 'T-voice' to the trans ear, expanded understanding of the intersections of voice and identity for this population, and desirable qualities in a voice for transmasculine folks.

Outside of research settings, this corpus could be used in gender-affirming voice therapy to guide clients in identifying voices and qualities that they find desirable, which will give them measurable data for goals relating to acoustics. It could also be used to practice vocal versatility with the same clients and explore the adjustments clients can make to their pitch, resonance, articulation, and intonation in order to achieve a sound closer to the voice they hear. This corpus provides dozens of examples of different ways to sound masculine, and also can help with validation and a sense of communal belonging for transmasculine clients.

Objectives 1 and 2: Corpus Development and Description

Below is the description of the development of the corpus used for this experiment. The intention for the corpus was to create and record speech materials that represented many ways of sounding masculine and to utilize phonemic parameters that could be targeted in voice therapy.

Methods

Talkers. Talkers were recruited via a digital flyer shared via private Facebook groups, the first being a Twin Cities' queer resource page with roughly 1,500 members, and the second a

page for a twin Cities queer arts organization with 185 members. The fliers for both parts of the experiment were posted at the same time; one for anyone who identified as masculine, the other for transmasculine folks only. The flyer was also shared in the student investigator's social circles of Minnesota locals. It identified the research study as one which aims to "better understand ways to provide transgender voice therapy" and used colors of the trans flag. The gender identity requirement was listed as "men and/or transmasculine, including non-binary, cis, and trans folks" with the intention of recruiting people who identify as masculine in any capacity. Other requirements listed were native English speaking, locality to the Twin Cities, access to transportation to the UMN campus, and age 18+. Compensation of \$50 was listed on the flyer and provided to all participants who completed a recording session. In the facebook posts advertising the study, this flyer was posted along with a link to a Google form for interested parties to determine eligibility. The google form asked for an email address, age, gender identity, race/ethnic identity, and where the subject grew up for the first 18 years of their life. The purpose behind the emphasis on locality was to minimize speech differences across regional varieties of English, since all participants in the rating studies were presently living in or around the Twin Cities.

Of the 47 respondents, 31 were eligible, and 20 completed recording sessions. Gender identity was self-reported with only a write-in option. All of these reporters felt comfortable aligning themselves as masculine in some way and grew up in or around the Twin Cities for a majority of the first 18 years of their lives. Pronouns were volunteered, not asked for. Racial identity was asked as a multiple-option list of NIH-developed racial categories, with a write-in option for any other racial or ethnic identities that the participant claims. Participant demographics are in Table 1. Sexuality and romantic orientation information were not gathered

from these participants but are important measures when considering perceived gender.

Demographic information for Objective 4 included sexuality and romantic orientation after consideration from the researchers on the importance of these criteria.

Table 1. *Demographics of the 20 Talkers.*

ID	Gender	Pronouns	Age	Race/Ethnicity
001	Non-binary trans man	He/they	24	White, Jewish
002	Cis man	He/him	33	White
003	Trans masculine / transexual / butch	They/them	23	Asian
004	Cis man	He/they	24	White
005	Trans man on T for 5 months		39	White
006	Masculine leaning non binary		32	White
007	Androgynous Trans Non-Binary	They/them	25	White
008	Male	He/him	30	Black, white
009	Male	He/him	61	White
010	Male	He/him	67	White

011	Transmasculine non-binary		23	Asian
012	Male	He/him	59	White
013	Cisgender man	He/him	34	White
014	Cis man	He/him	30	White
015	Part gay man part badass dyke aka non-binary	They/them	39	White
016	Cisgender man but idk	He/him	31	Black, Latino
017	Male, transgender		48	Indigenous
018	Non-binary, but with recognition of being assigned male and not full rejection of it.	They/he	35	White
019	Male	He/him	29	Asian
020	Nonbinary Man		25	Jewish

Of all 47 respondents to the original posting, 65% self-identified as non-cis. Interested non-cisgender parties who were ineligible due to locality were extended an invitation to participate in the next phase of the experiment. Data on sexual orientation of the talkers was not gathered, however based on the nature of the recruitment process, conversations with participants

during the sessions, and data on gender identity, it is estimated that 85% of participants claimed 1 or more identities under the LGBTQ+ umbrella, while 15% claimed none.

Speech Materials. The speech materials were two sets of sentences. Six of these were the standardized CAPE-V sentences (Kempster et al., 2009), which are typically used for assessments of voice quality. Twenty-seven sentences were created specifically for this project, and were designed to over-sample phonemes that have been associated with gender in previous studies, like /s/ (Munson et al., 2006; Stuart-Smith, 2007; Zimman, 2017a, 2017b) and voiceless stops (Ryalls et al., 1997) In each of the first 9 sentences, the phonetic makeup contained 2 s-initial words and 2 /p, t, k/ initial words. The following 18 sentences contained no word initial /s, p, t, k/. Each sentence contained at least 5 content words and had a variety of stressed vowels.

Table 2. *Sentence Stimuli*

Sentence number	2 s-initial words and 2 /p, t, k/ initial words
1	This park has a secret picnic spot behind the flower garden.
2	Every winter, you can see tiny rabbits hopping through the snow.
3	Strawberries grow in the summer, provided they are planted in spring.
4	To make a table, cut some planks from trees and screw them together.
5	Tea is coming through cracks in the surface of this ceramic.
6	Yesterday my penny got stuck in the school’s vending machine, but I got it out with a paperclip.
7	Honey bees eat sweet syrup, but they also enjoy fruits such as plums and peaches.
8	Small puppies reach their adult dog size when they are twelve months old.
9	Stretching helps keep muscles flexible and strong, plus it prevents cramps.

Sentence number	No word initial /s, p, t, k/
10	An ample wall needs at least four layers of bricks.
11	There is one arm muscle in the human body that is only used when lifting your little finger.
12	During a double rainbow, one rainbow is noticeably brighter than the other.
13	Yesterday I saw a blue rooster behind a barber shop.
14	Elevators usually have one up button and one down button.
15	I rolled my windows down, but it didn't break the ice frozen to them.
16	Red grapes and green grapes are alike in the vitamins, minerals, and fiber they have.
17	If you open the microwave before it reaches zero, it won't beep.
18	The bike rack by the river is shaped like fish.
19	Did you see that bird fly right into the window?
20	A shadow is a dark area where light is blocked by an object.
21	That yellow onion is much larger than all of those red onions.
22	Many artists use water-activated ink in their markers.
23	Their glass broke horizontally down the middle.
24	Let me hold onto that for you until we're done.
25	Writing music is relatively difficult for those with no experience.
26	Electricity is used for light and energy all over the world.
27	Why doesn't this bathroom have hand dryers mounted to the wall?

Procedures. Upon arrival at the lab, participants gave informed consent and were taken to a soundproof recording booth. Participants were shown a slideshow on a computer monitor which displayed one sentence at a time. They were instructed to say the sentences in the most conversational, natural voice they could muster, as opposed to a more performative “reading

voice”. They read the 6 CAPE-V sentences one at a time. Following this and any necessary sound level adjustment on the recording equipment, they spoke 27 sentences 3 times each, with additional takes if they stumbled over any words or asked to do it again. The student investigator spoke the sentence first using unnatural inflection and emphasis while the talker looked at a blank screen, then the screen showed the sentence and the talker read it in their conversational voice. This method was taken from Tripp, Lyons, and Munson (2022). Its purpose was to encourage speech naturalness by hearing the words before reading them, and to discourage matching the inflection of the tester’s initial read of the sentence. The stimuli were recorded on a solid-state recorder using a AKG C420 head-mounted microphone. The sentences were presented and recorded in the same order for each participant. Following each group of 9 sentences, the participant was offered a short break and a drink of water. Once the final sentence was recorded, the participant was paid \$50 in cash plus parking reimbursement.

Acoustic Analysis. A series of acoustic analyses of the 27 novel sentences was conducted. The goal of this analysis was to describe the speech of the 20 talkers using measures that have been shown previously to be associated with gender identity and perceived gender. Many such measures exist, and a comprehensive analysis of these 20 talkers is beyond the scope of this paper; in this paper, we focus on four measures. The first of these is average fundamental frequency (f_0). This measure is widely associated with gender in research studies, and in public discourse about men and women’s speech. The second is acoustical vocal-tract length (henceforth aVTL). This measure is described in Johnson (2020). It is calculated by first taking the average of the lowest three formant frequencies, then calculating an estimate of vocal-tract length using the odd-quarter formula separately for each of these formants, then averaging those estimates. Lammert and Narayanan (2015) showed that this measure is correlated with physical

measures of vocal-tract length resting-state measures. The imperfect correlation between aVTL and actual vocal-tract length might reflect the fact that aVTL also reflects the active maneuvers that individuals make while speaking to lengthen or shorten their vocal tracts as part of their performance of gender. Acoustic measures similar to aVTL have been shown previously to differ between men and women, and to strongly predict judgments of gender (Skuk & Schweinberger, 2014). The third measure is the spectral center of gravity (i.e., the first spectral moment) of word-initial /s/. This measure differs between men and women (Munson et al., 2006)—women have lower COG than men—and predicts judgments of masculinity and femininity through speech (Munson, 2007). The final measure was spectral standard deviation (i.e., the second spectral moment) of word-initial /s/. This measure differs between men and women: men have a higher SD than women. Higher COG and low SD are both associated with prescriptive judgments of more accurate /s/ (Mack & Munson, 2012).

Measures were extracted using the acoustic analysis software Praat (Boersma, 2001). The Montreal Forced Aligner (McAuliffe et al., 2017) was used to segment words and phonemes. The f0 was extracted in Praat using the default settings. The F1, F2, and F3 were extracted using the LPC formant tracker with settings midway between those for adult men and adult women. These measures were extracted at the midpoint of every monophthongal vowel in a primary or secondary stressed syllable. The spectral center of gravity and standard deviation for word-initial /s/ was based on a 40 ms interval of frication centered on the midpoint of the sound. This was high-pass filtered with a cutoff of 500 Hz to remove any artifacts from coarticulatory voicing.

The figure below shows the mean f0 and mean aVTL for each of the 20 talkers. As this figure shows, these variables were moderately negatively correlated, with the exception of one individual who has a high aVTL (i.e. a ‘longer-sounding’ vocal tract) and a high f0. For

reference's sake, the average aVTL and f_0 for men and women reported by Hillenbrand et al. (1995) is included in this figure. We calculated aVTL from the values presented in Table V of that study. The averages were, for men: aVTL = 16.5 cm, f_0 = 130 Hz; for women: aVTL = 14.7 cm, f_0 = 220 Hz. There was a cluster of individuals around the mean values for men. None of the values approach those for the women in that study.

Objective 3 of this thesis was to examine the perception of the 20 talkers described in this section. As described in more detail below, the perception experiment only used a subset of the productions described in this section. Figure 1 plots the average f_0 and aVTL for each of the talkers both for the full set of productions, and for the subset of the productions used in Objective 3. It is presented here to verify that the subset of tokens used in Objective 3 do not represent outliers in the full data set.

Figure 1. *Average f_0 and aVTL for the 20 talkers, plotted for the full set of productions (filled squares) and the subset used as stimuli in Objectives 3 and 4 (open squares). The blue and red H*

indicate the mean values for men and women, respectively, in Hillenbrand et al. (1995)

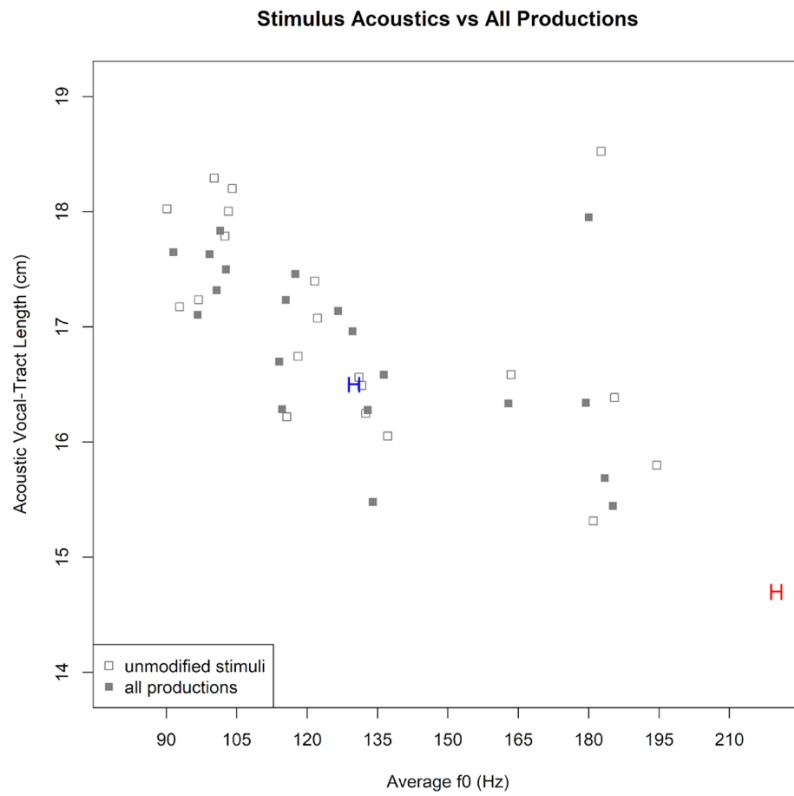
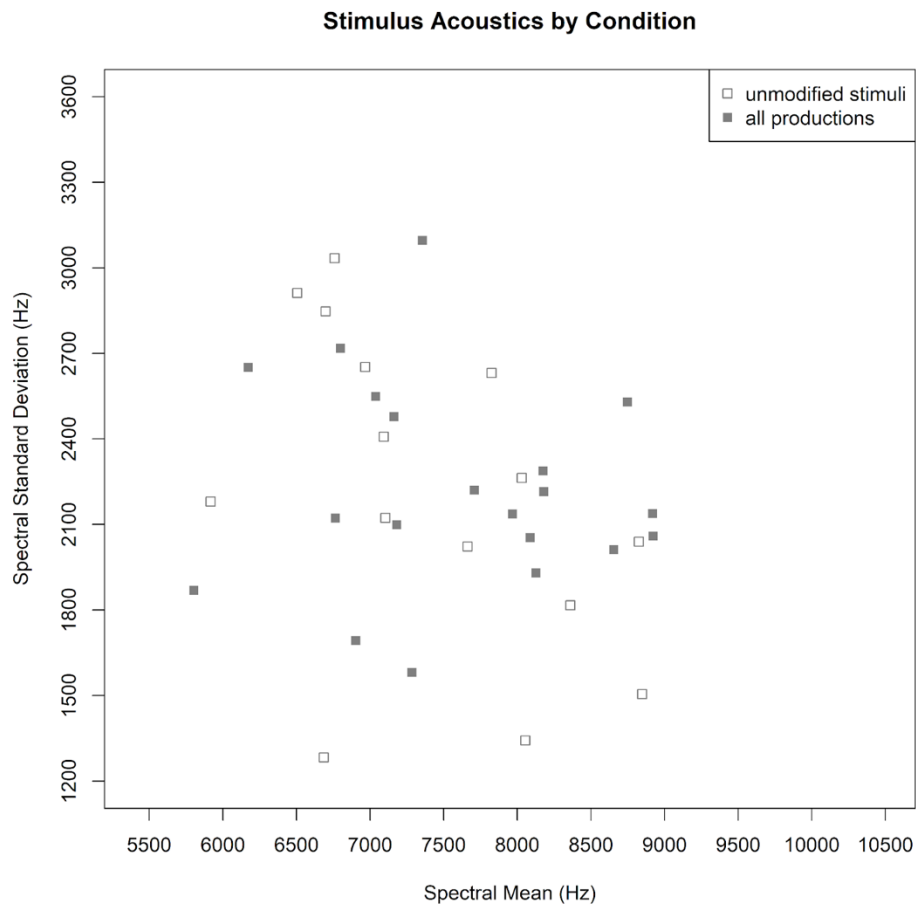


Figure 2 shows the two /s/ measures. Again, there was wide variation in both of these measures.

Figure 2. Average /s/ Spectral Center of Gravity and Spectral Standard Deviation for the 20 talkers.



As expected, the talkers varied considerably in many acoustic dimensions that are associated with gender. The talkers had diverse gender identities. One striking aspect of these data, however, is that while they vary in aVTL and f_0 , these two measures are correlated relatively strongly with the exception of just one individual. This necessitated thinking differently about how to use these stimuli in rating experiments. If they were used ‘as is’, then we would not be able to assess whether aVTL and f_0 contribute differently to different perceptions.

Objective 3: Ratings from a Community Sample

Objective 3 of this project was to examine how the 20 talkers are perceived along different dimensions by different groups of listeners, including cisgender heterosexual men (CHM), cisgender heterosexual women (CHW), and people who are not cisgender, not heterosexual, or both. We refer to the latter group as *gender and sexuality expansive* (GSE). The purpose of the experiment was to track listener perceptions of qualities based on concerns that trans folks brought up in gender-affirming voice therapy with the PI at the University of Minnesota's Lions Voice Clinic, under the supervision of a licensed speech-language pathologist with expertise in gender-affirming voice therapy, Daniel Weinstein, MM, MA, CCC-SLP. In these sessions, many trans folks brought up different desires and goals for their voice as well as insecurities. Some trans people wanted to sound gay, but not trans; others wanted to pass as a cisgender person to everyone they spoke to no matter what their voice sounded like; still others wanted to utilize a wide pitch and inflection range. Many folks expressed concerns about their voices sounding fake, inauthentic, or unfriendly. The goal of the experiment was to gather data on the perceptions of both cis and trans folks on the vocal qualities that were directly asked about in voice therapy sessions: authoritativeness, insecurity, friendliness, fakeness, and gayness – in addition to likability of the voice. Ratings like those in this section could potentially be used to counsel individuals who wish to change their voices, to show them the affective qualities that are associated with different combinations of phonetic characteristics. In addition to questions about gender perception, a question about perceived age was included to encourage participants to include consideration of voice factors unrelated to gender.

This rating experiment also provides the opportunity to examine how perceptions of gender-diverse voices differ across listener groups. Often, presentations of queerness shift depending on the social scenario (Zimman, 2018). For example, a person might use a different

lexicon and speak with different intonational patterns depending on whether they are surrounded by queer people with whom they are comfortable, as opposed to a work function with folks who do not share the speaker's identity. It is important that gender-affirming voice clients gain an understanding of how their voices are perceived by different groups of people, so that they might make informed adjustments based on how they want to present their gender in any given situation. Hence, the listener groups for this experiment contained people from varied gender, sexuality, and racial backgrounds.

Methods

Stimuli. Because the experiment was administered remotely, it was necessary to limit the number of productions that were used as stimuli. To ensure that the entire experiment would take no longer than 1 hour, we selected 240 sentences from the full set of sentences to use as stimuli. The sentences that were selected represented the widest available array of acoustic measures. These were divided into four groups of 60 sentences each. Each of the sets of stimuli were administered to different groups of participants. Within each stimulus set, there were 20 sentences that were loaded with /s/-initial words and 40 that were not. Each of the 20 talkers contributed six sentences to each of the experiments. Each of the sentence types (i.e., the unique sentences from Table 2) appeared 2-3 times within each stimulus set, never by the same talker.

The acoustic analyses in the previous section confirmed that the talkers varied considerably in a variety of acoustic parameters associated with gender. However, as noted above, they do not represent the full range of possible variation. For Objective 3, we increased that variation by manipulating the sentences acoustically. We achieved this by changing the mean f0 and the aVTL in Praat, using a script by Darwin (2005). Each sentence's f0 and aVTL were raised or lowered 10%. This resulted in five stimulus types (original, raised f0, lowered f0,

raised aVTL, lowered aVTL). Within each condition of the experiment, there were 12 stimuli from each of five stimulus types. Within each condition, we never presented more than one stimulus type for each talker-plus-sentence combination. The assignment of recordings to stimulus condition can be found in Appendix 1, and the full set of stimuli (which the participants agreed to share in an open-access format when consenting) can be found [here](#). Figures 3 and 4 below plot the average f_0 and aVTL (Figure 3) and average /s/ spectral center of gravity and spectral standard deviation (Figure 4) for the full set of stimuli. As these Figures show, the manipulations achieve the goal of increasing variation in the stimuli considerably.

Figure 3. Average *aVTL* and *f0* for Stimuli, Separated by Manipulation Condition

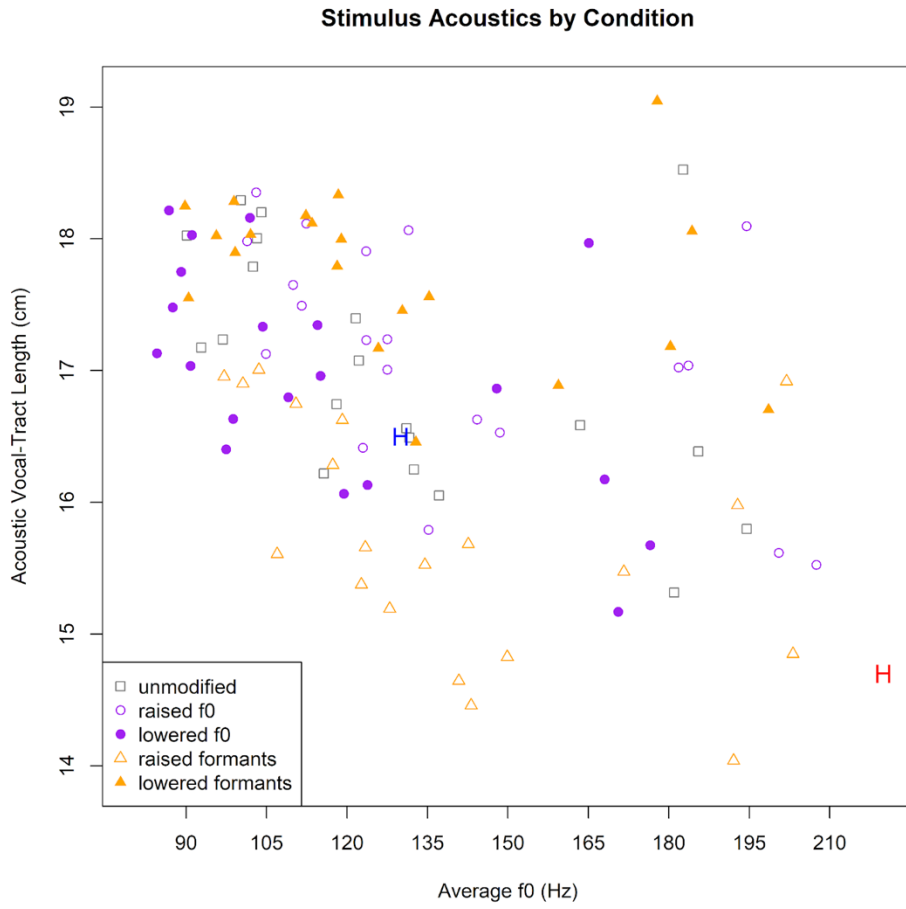
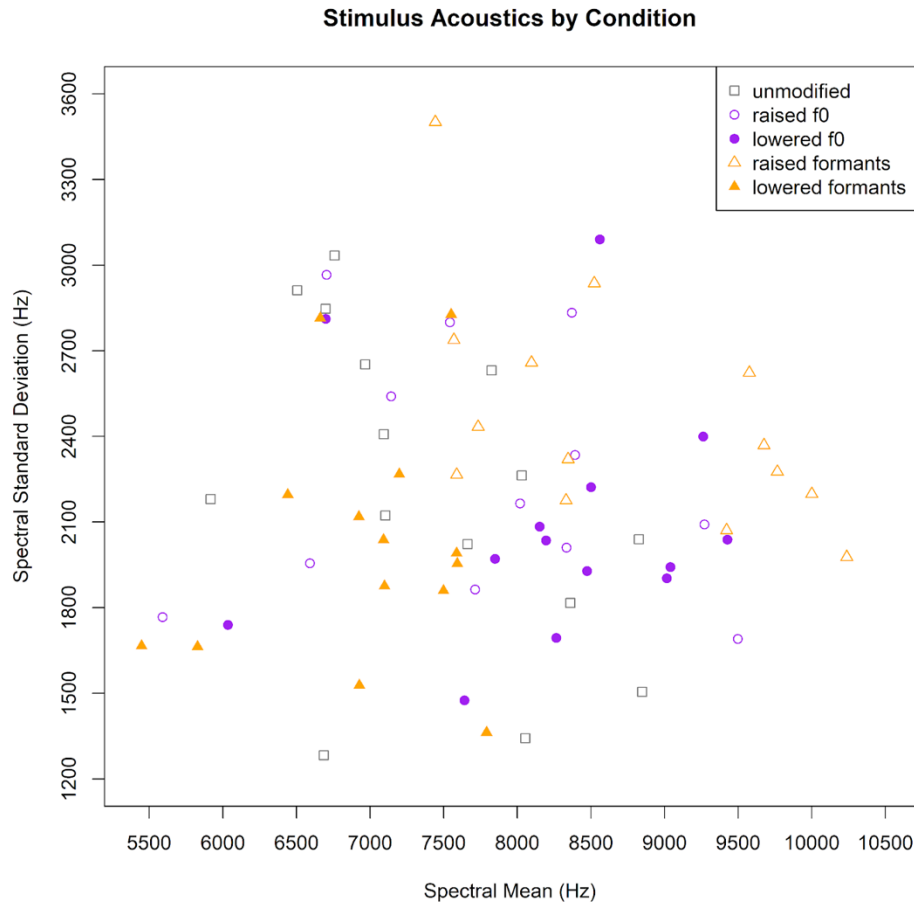


Figure 4. *Average Spectral Mean and Spectral Standard Deviation for Stimuli, Separated by Manipulation Condition*



Participants. A group of 199 individuals was recruited from the website Prolific Academic (www.prolific.co, henceforth *Prolific*). Prolific allows experimenters to recruit people with specific characteristics. Two pools of participants were recruited: One pool recruited people who did not identify as transgender, lesbian, gay, bisexual, or any combination of those characteristics. This group comprised 149 individuals (88 men, 62 women) of various racial identities. The second pool included people who identified as gay, lesbian, bisexual, non-binary, transgender, or some combination of those identities. This group comprised 50 individuals of

various racial identities. The participants were 18-50, listed English as their first language, were in the US or Canada, and listed no current or past learning disabilities, hearing impairment, or head injury. The fine-grained demographics of the 199 participants is given in Tables 3 and 4.

Table 3. *Participants separated by Gender (columns) and Racial Identity (Rows)*

Racial Identity	Cis women	Cis men	Trans women	Trans men	Gender identity not listed	GQ ^a	Total
Asian	7	16	1	0	0	0	24
Black	9	10	0	1	1	1	22
White	37	47	4	7	4	25	124
Multiple Races	5	9	1	1	1	3	20
Other	4	5	0	0	0	0	9
Total	62	88	6	9	6	29	199

^aGenderqueer

Table 4. *Participants separated by Gender (columns) and Sexuality (rows)*

Sexuality	Cis women	Cis men	Trans women	Trans men	Gender identity not listed	GQ	Total
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Heterosexual	62	87	0	0	0	0	149
Bisexual	0	0	4	5	4	15	28
Homosexual	0	0	2	1	1	8	12
Asexual	0	0	0	3	1	6	10
Total	62	87	6	9	6	29	199

Procedures. The experiment began with a consent form. After this, listeners were presented with several sample audio clips to allow them to adjust the output level to one that was both comfortable, and for which the speech samples were maximally audible. After this, people were given the following instructions:

In this task, you will listen to 60 different sound clips and answer questions about the speech and voice patterns of the person who you listened to. When we say speech and voice, we mean that you should answer the question about the way that people speak, not the words and sentences that they say. All of the people who you will listen to in this task were recorded saying the same set of sentences, which we selected, so the differences between these people that we ask you to pay attention to are the way they speak. At the top of each screen is an audio prompt. After you listen to the audio file, you will be presented with questions and you will indicate your answer on each, given the presented options. We ask you to go with your 'gut instinct' when making these decisions. Our goal is not to measure people's accuracy, but to examine the range of responses that people give in tasks like this.

They were then presented with a sound file, followed by a series of questions. The first was *If you had to guess, would you be reasonably certain that you can guess the age of the person who produced this sentence?* People who answered yes were given the prompt *What is your general guess on the age (in years) of the person who produced this sentence? It's OK if your age guess is simply around the age you believe the person to be. Please enter one number*

only. They entered a number. After that, they were asked the question *If you had to guess, would you be reasonably certain that you can guess the gender of the person who produced this sentence?* People who answered yes were prompted to choose among *Man, Woman, or A gender that is neither exclusively 'man' nor exclusively 'woman'*. Next, they were asked *If you had to guess, would you be reasonably certain that you can guess whether the speaker is cis (identifies with the sex they were assigned at birth) or trans (does NOT identify with the sex they were assigned at birth)?* People who answered yes were prompted to choose among *Cis man, Cis woman, Transmasculine person/trans man, Transfeminine person/trans woman, Nonbinary, Other*, with a write-in option to supply a label.

Finally, people were asked for their agreement with seven statements on a five-point Likert scale (definitely disagree, disagree, neither agree nor disagree, agree, definitely agree). The statements were: *This person's voice sounds authoritative, This person's voice sounds insecure, This person's voice sounds friendly, This person's voice sounds fake, This person's voice sounds gay, I like listening to this person talk, This person's voice is unpleasant to listen to.*

Analysis. A variety of analyses were conducted. For each of the ten questions (Age, Gender, Cis/Trans, and the agreement with the seven statements), we examined whether the distribution of answers differed across the three listener groups (CHF, CHM, GSE) using chi-square tests of independence, with responses pooled across individual participants. The use of chi-square tests of independence to examine group differences is suboptimal, in that it does not model individual differences among listeners within categories. The only statistical analysis technique that is suited for such data is a multinomial logistic mixed-model regression. These models are outside of the scope of expertise of both the author and the primary adviser, and

hence are not included in this document. We supplement these with visualizations of selected findings.

For continuous responses to the seven ‘agreement’ questions, we describe the distribution of ratings across the three groups and use linear mixed-effects models to examine whether group, aVTL, and f0 as the predictors. Given the restricted range of the dependent measure, it was modeled as a Poisson distribution, as in Munson et al. 2015, (though see Schielzeth et al., 2020, for evidence that mixed-effects models are robust to restricted ranges of dependent measures). For categorical measures, we use chi-square tests of independence to measure whether responses differ across these two groups.

Results

Age. Table 5 shows the proportion of items that were given ‘yes’ answers to the question about age (*If you had to guess, would you be reasonably certain that you can guess the age of the person who produced this sentence?*), separated by group. The table shows a slightly higher percentage of ‘yes’ responses for the CHM group than for the other three. This is statistically significant in a chi-square test of independence ($\chi^2_{(df=2)}=7.45, p=0.024$).

Table 5. *Proportion of responses to the question about Age, Separated by Group*

Group	No	Yes
GSE	0.569	0.431
CHF	0.559	0.441
CHM	0.540	0.460

As this table shows, the small differences across groups occurred because the CHM listeners were less likely to answer ‘no’ than the CHF group, who was less likely than the GSE group to answer ‘yes’. We return to this finding below.

Gender. Table 6 shows responses to the question *If you had to guess, would you be reasonably certain that you can guess the gender of the person who produced this sentence?* followed by a choice from a list of three (*Male, Female, A Gender that is neither exclusively male nor exclusively female*) for those who answered yes. The table combines responses to the two questions. The distribution of responses across groups was highly significantly different from chance, as shown in a chi-square difference test, ($\chi^2_{(df=6)}=174.72, p<0.001$).

Table 6. *Proportion of responses to the question about Gender, Separated by Group*

Group	Yes (Male)	Yes (Female)	Yes (Other)	No
GSE	0.537	0.156	0.073	0.234
CHF	0.610	0.166	0.038	0.186
CHM	0.630	0.184	0.037	0.149

Table 6 shows that the GSE group was less likely to say ‘yes’, male, or female, and more likely to give a response of ‘a gender that is neither exclusively male nor exclusively female’. As with the age question, the CHM participants were less likely to answer ‘no’ than the CHF group, who were less likely to answer ‘no’ than the GSE group.

To explore how the acoustic characteristics of the stimuli affected the ratings of participants in the three groups, we inspected a variety of visualizations of these data. Representative samples for these are Figures 5, 6, and 7 illustrate the different ways that aVTL and f0 affected the proportion of ‘no’ responses to each stimulus by the three groups of listeners.

These Figures show the stimuli from Figure 3, shaded by the proportion of listeners in each group that responded 'no' to each question.

Figure 5.

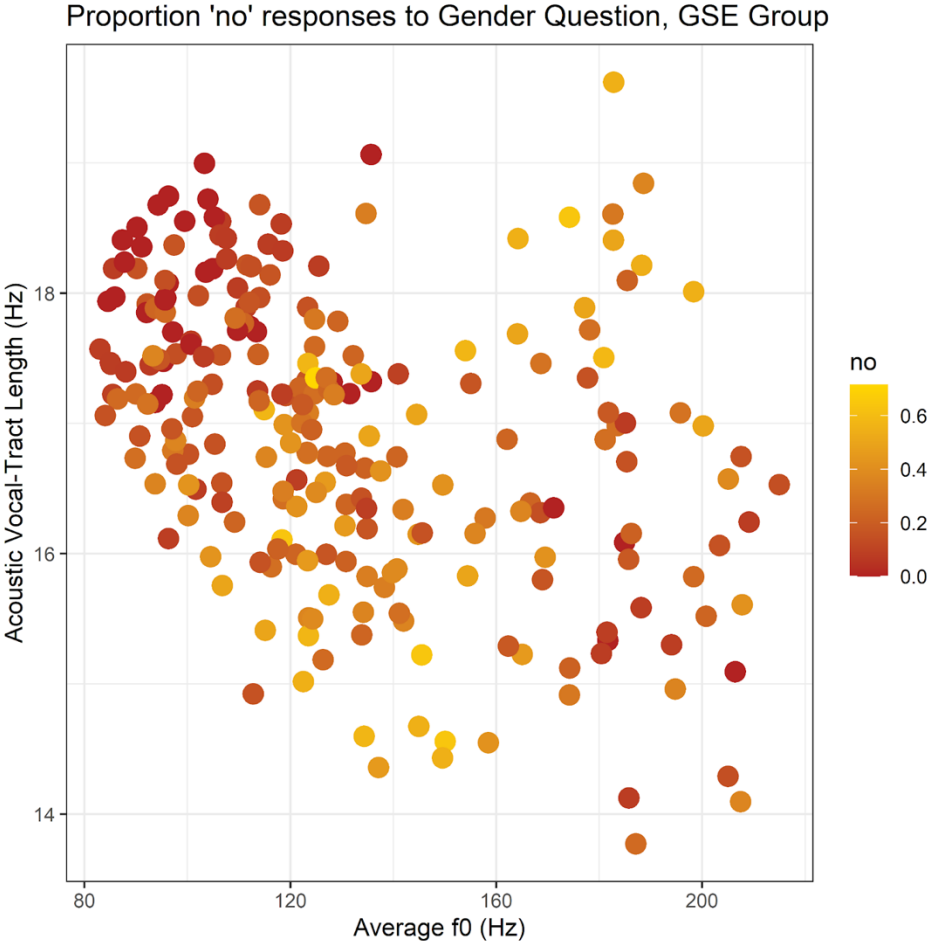


Figure 6.

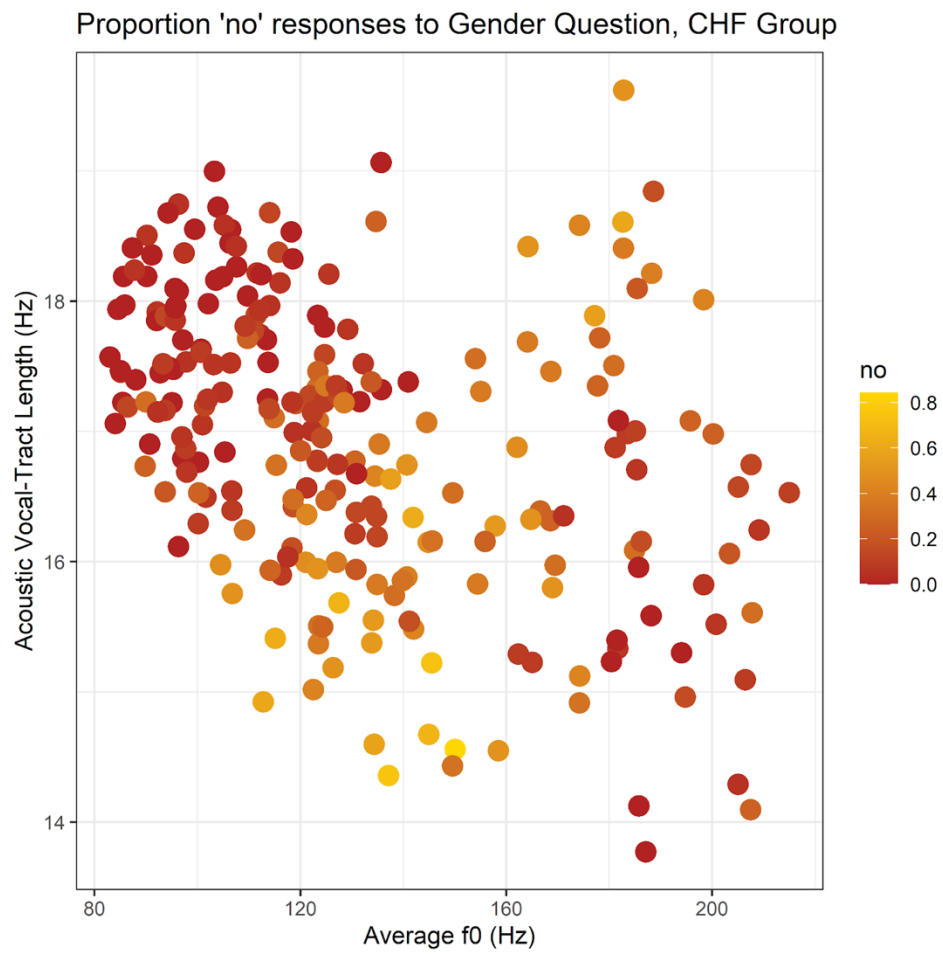
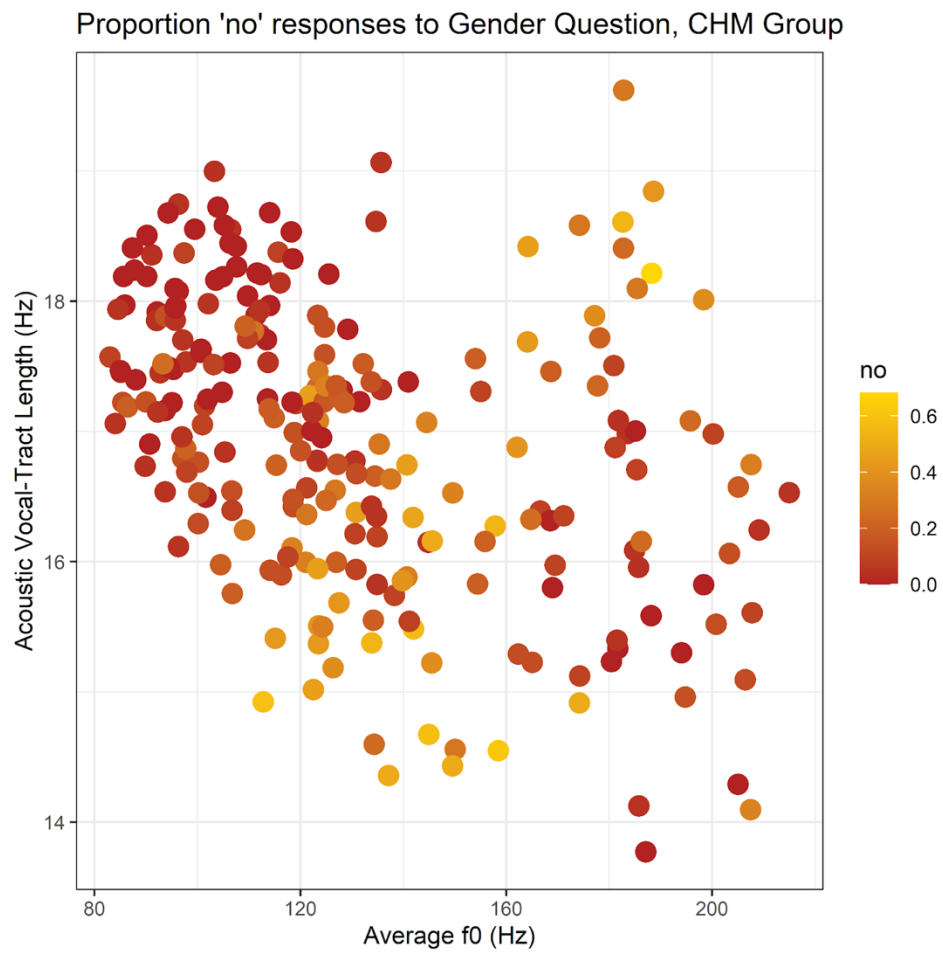


Figure 7.



These figures show somewhat unsurprisingly that the highest rate of 'no' responses was given for the stimuli whose combination of f0 and aVTL was far away from the values for men

and women given in Hillenbrand et al. (1995), as shown in Figures 1 and 3. It is notable that the GSE group had more ‘no’ responses than either of the other groups to stimuli that had $f_0/aVTL$ combinations that are consistent with men in previous studies, including many stimuli in the cluster low f_0 /high $aVTL$ stimuli in the upper-left quadrant of these figures. Figures 8, 9, and 10 show the proportion of Yes (Male Responses) for the same stimuli and the same listeners.

Figure 8.

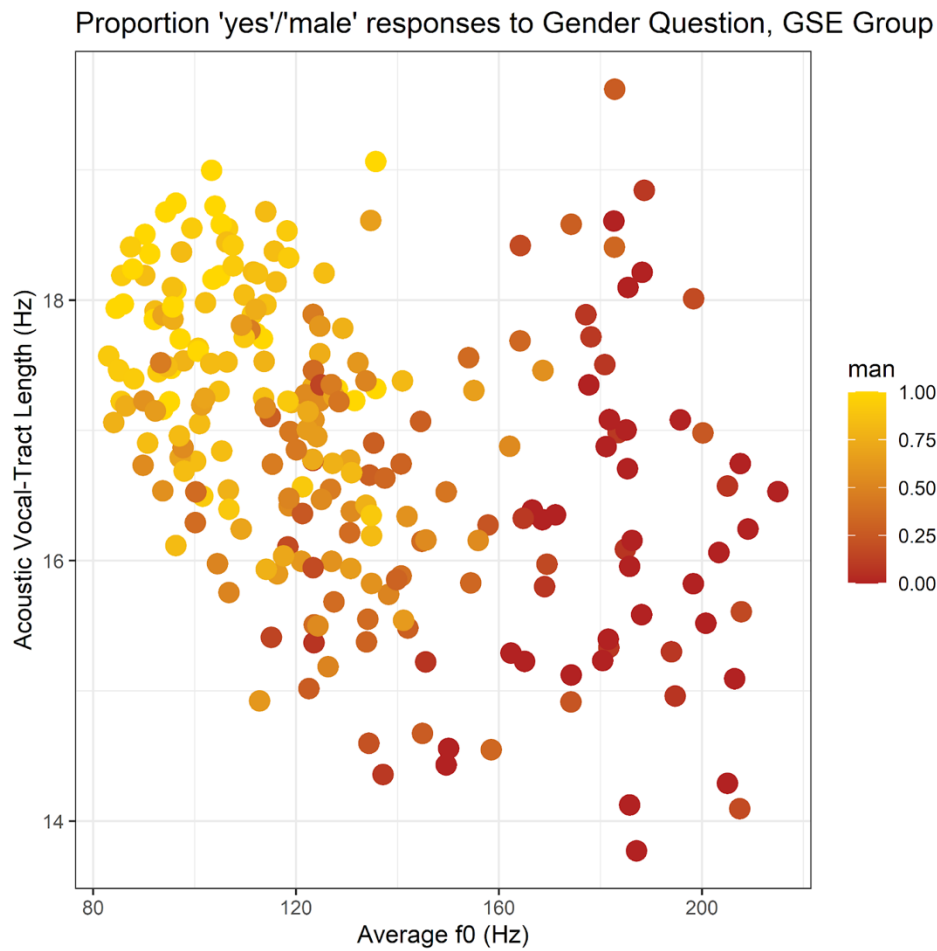


Figure 9.

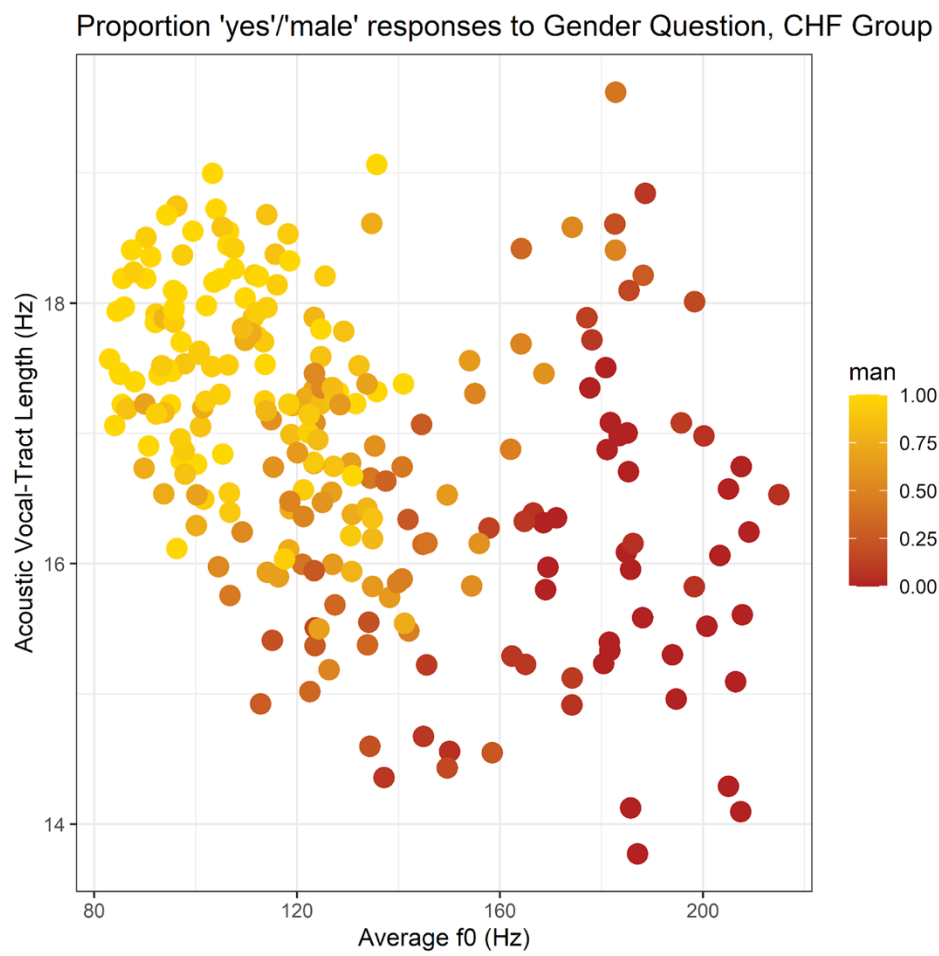
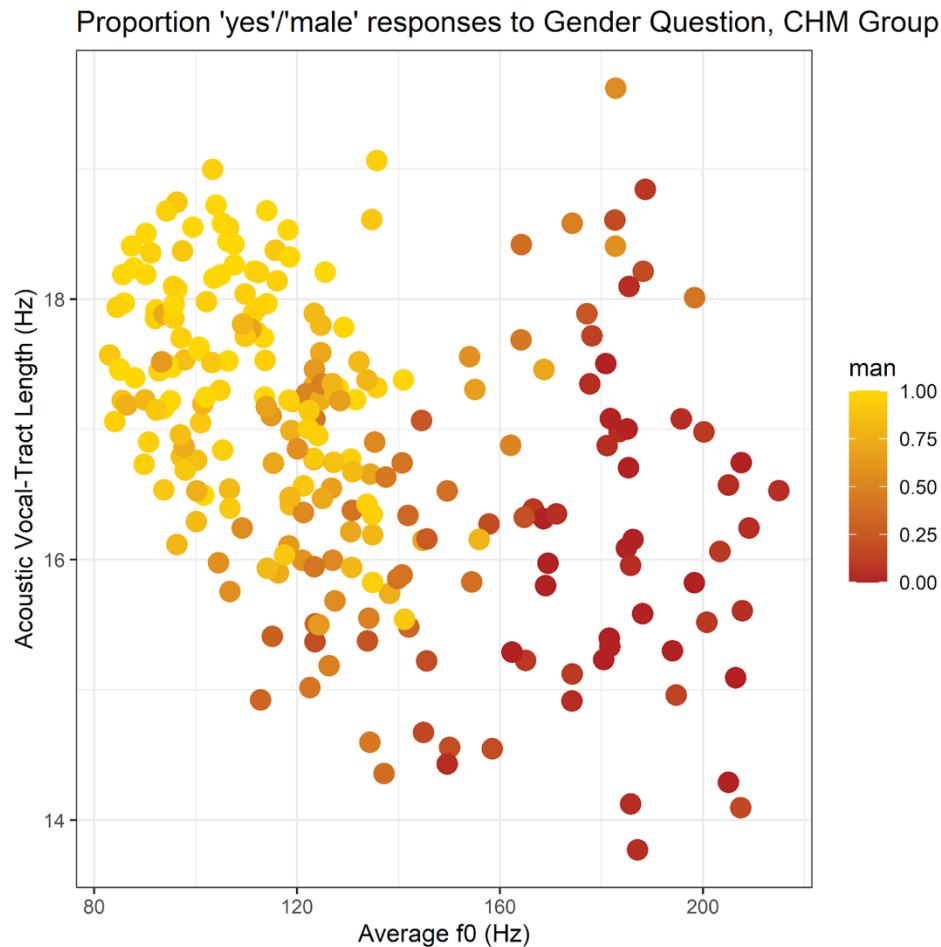


Figure 10.



Figures 8-10 complement Figures 5-7, in that they show that listeners in the GSE group were less likely to label a stimulus Male than listeners in the other two groups, even when the stimuli had acoustic values consistent with those of men in studies like Hillenbrand et al.

Cis/Trans. Table 7 shows the proportion of items that were given 'yes' answers to the question *If you had to guess, would you be reasonably certain that you can guess whether this person is transgender or not?* followed by a choice from a list of six (Cis man, Cis woman, Transmasculine person/trans man, Transfeminine person/trans woman, Nonbinary, Other). The table combines the answers to these two questions; the measure here is whether the person said

no, yes+cis man, yes+ciswoman, yes+transman, yes+transwoman, yes+nonbinary, or yes+other, separated by listener group. This difference is highly significant in a chi-square test of independence ($\chi^2_{(df=12)}=202.94, p<0.001$),

Table 7. *Proportion of responses to the question about Cis/Trans Separated by Group*

	Yes (Cisgender man)	Yes (Cisgender woman)	Yes (Trans man)	Yes (Trans woman)	Yes (Non-Binary)	Yes (Other)	No
GSE	0.209	0.048	0.073	0.048	0.058	<0.001	0.563
CHF	0.201	0.054	0.036	0.043	0.034	<0.001	0.632
CHM	0.238	0.056	0.035	0.048	0.018	0.001	0.604

The pattern of yes/no responses is notable in that the GSE group were less likely to answer no than the other groups, in contrast to the question about gender, and were more likely to label someone as transmasculine or nonbinary, though the rates for both of these answers were low overall.

The remaining seven questions asked about participants' agreement with the seven questions listed above. The proportions of responses to these questions, separated by group, are in Table 8, followed by analyses of responses to the individual questions.

Table 8. *Proportion of responses to the seven agreement questions, separated by group.*

Question	Group	Answer				
		Definitely disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree
	GSE	0.231	0.210	0.148	0.282	0.129

This person's voice sounds authoritative	CHF	0.215	0.229	0.199	0.266	0.092
	CHM	0.241	0.233	0.210	0.248	0.068
This person's voice sounds insecure	GSE	0.282	0.247	0.177	0.232	0.062
	CHF	0.216	0.264	0.229	0.186	0.105
	CHM	0.232	0.260	0.211	0.204	0.093
This person's voice sounds friendly	GSE	0.302	0.205	0.220	0.195	0.079
	CHF	0.219	0.258	0.208	0.221	0.094
	CHM	0.264	0.240	0.236	0.204	0.056
This person's voice sounds fake	GSE	0.280	0.190	0.241	0.226	0.062
	CHF	0.245	0.242	0.272	0.188	0.053
	CHM	0.240	0.259	0.244	0.198	0.059
This person's voice sounds gay	GSE	0.196	0.242	0.239	0.238	0.084
	CHF	0.237	0.254	0.207	0.225	0.077
	CHM	0.220	0.252	0.238	0.225	0.066
I like listening to this person talk	GSE	0.241	0.198	0.197	0.238	0.127
	CHF	0.273	0.256	0.268	0.154	0.049
	CHM	0.210	0.214	0.259	0.246	0.071
This person's voice is unpleasant to listen to	GSE	0.301	0.219	0.229	0.173	0.078
	CHF	0.219	0.201	0.284	0.209	0.087

	CHM	0.215	0.234	0.297	0.180	0.074
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The distribution of responses to the question *This person's voice sounds authoritative* across the three listener groups is highly significant in a chi square test of independence. ($\chi^2_{(df=8)}=136.76, p < 0.001$). One striking difference across groups is that the CHM participants were considerably less likely than the other two groups to agree (either somewhat or definitely) with this statement. We conducted a second analysis in which the agreement scale was converted to a numeric rating. We then conducted a linear mixed-effects model predicting that rating from group, and from two acoustic measures: aVTL and f0. We included terms for the interaction between group and each of these measures. This design allows us to examine whether f0 and aVTL predicted ratings, whether listener group predicted rating (essentially replicating the chi square analysis), and whether any effects of aVTL and/or f0 on ratings were equivalent across the three groups. Participant and item were included as random effects. These were fit using the lme4 package in R (Bates et al., 2015), with significance-test values calculated using the LmerTest package (Kuznetsova et al., 2017). For the model predicting authoritativeness ratings, there was a strong influence of aVTL on ratings: 'longer-sounding' vocal tracts were associated with lower ratings of authoritativeness ($\beta=-.074$ SEM=.022, $t[2247]=-3.340$ $p<0.001$, using Satterthwaite's approximation for degrees of freedom). No other acoustic predictors were found, and they didn't interact with group.

The distribution of responses to the question *This person's voice sounds insecure* across the three listener groups is highly significant in a chi square test of independence ($\chi^2_{(df=8)}=109.52, p < 0.001$). It is notable that the GSE participants were more likely than the other two groups to "definitely disagree" with this statement. For the linear mixed-effects model predicting insecurity

ratings, there was a strong influence of aVTL on ratings: ‘longer-sounding’ vocal tracts were associated with less insecurity ($\beta=-0.102$, $SEM=.026$, $t[796.8]=-3.928$, $p<0.001$). The effects of aVTL on authoritativeness ratings were stronger for the CHF and CHM groups than for the GSE group.

The distribution of responses to the question *This person’s voice sounds friendly* across the three listener groups is highly significant in a chi square test of independence ($\chi^2_{(df=8)}=124.43$, $p < 0.001$). One interesting finding is that the GSE participants were substantially less likely to answer “definitely disagree” to this question. For the linear mixed-effects model predicting friendliness ratings, there was a strong influence of aVTL on ratings: ‘longer-sounding’ vocal tracts were associated with less friendliness ($\beta=-0.103$, $SEM=.023$, $t[1178]=-4.461$, $p<0.001$). There was an effect of f0 on the ratings of the CHM group (lower f0s were associated with being less friendly) but not for the ratings made by participants in the other two groups.

The distribution of responses to the question *This person’s voice sounds fake* across the three listener groups is highly significant in a chi square test of independence ($\chi^2_{(df=8)}=75.506$, $p < 0.001$). One notable finding is that the GSE participants were considerably more likely than the two other groups to “definitely disagree” with this statement. For the linear mixed-effects model predicting fakeness ratings, there was a strong influence of aVTL on ratings: ‘longer-sounding’ vocal tracts were associated with less fake-sounding voices ($\beta=-0.062$, $SEM=.022$, $t[1580]=-2.862$, $p=0.004$). The influence of aVTL on the ratings by the CHF group was stronger than its influence on the ratings of the other two groups.

The distribution of responses to the question *This person’s voice sounds gay* across the three listener groups is highly significant in a chi square test of independence ($\chi^2_{(df=8)}=36.929$, $p < 0.001$). There appears to be a slightly lower tendency for the GSE group to definitely disagree

with the statement, but otherwise the ratings appear to be similarly distributed. In the linear mixed-effects model predicting gayness ratings, there was a strong influence of aVTL on ratings: ‘longer-sounding’ vocal tracts were associated with less gay-sounding voices ($\beta=-0.123$, $SEM=.022$, $t[1611]=-5.642$, $p<0.001$). This effect was stronger for the CHF and CHM groups compared to the GSE group, and the CHM group also showed an effect of f_0 on gayness ratings, where higher f_0 was associated with judgments of more gay-sounding speech.

The distribution of responses to the question *I like listening to this voice* across the three listener groups is highly significant in a chi square test of independence ($\chi^2_{(df=8)}=340.89$, $p < 0.001$). The data show a strikingly lower proportion of CHF participants agreeing with that statement than participants from the other two groups. In the linear mixed-effects model predicting these ratings there was a strong influence of aVTL on ratings: ‘longer-sounding’ vocal tracts were associated with less likable voices ($\beta=-0.145$, $SEM=.024$, $t[1020]=-6.065$, $p<0.001$).

The distribution of responses to the question *This voice is unpleasant to listen to* across the three listener groups is highly significant in a chi square test of independence ($\chi^2_{(df=8)}=129.88$, $p < 0.001$). Here, a strikingly higher proportion of GSE participants disagreed with this statement than participants from the other two groups. For the ‘like listening’ ratings, there was a strong influence of aVTL on ratings: ‘longer-sounding’ vocal tracts were associated with greater agreement with this question ($\beta=-0.053$, $SEM=.020$, $t[1974]=-2.604$, $p=0.009$).

Considering these 10 ratings together, some important patterns emerge. First, the CHM’s responses to the Age and Gender questions suggest greater confidence than the other two groups in appraising these two aspects of identity. However, they were less confident in their rating of whether someone is Cis or Trans. This is potentially due to a hesitancy to make judgements regarding identities that cis/het men are not as familiar with; since they all have an age and a

gender, they feel more comfortable guessing that of others’, but they have less personal experience to draw from when determining whether someone is cis or trans. Second, in examining responses to the agreement questions, the GSE group was overall more positive in their appraisal of these voices than the other two groups. This invites a consideration of the different social-psychological processes that contribute to these perceptions in the GSE, CHF and CHM groups. For example, the GSE group might have perceived these voices as violating cisgender, heterosexual norms for voice, and their responses might have reflected their positive appraisal of someone who shares an aspect of their gender or sexual identity. The linear mixed-effects model showed that aVTL affected ratings much more strongly and consistently than f0.

The specific agreement questions were developed from interactions with clients in gender-expansive voice therapy. To examine whether they elicited independent information about the samples being rated, we examined correlations between the agreement (expressed as a five-point ordinal scale) for each of the seven questions. Spearman’s correlation coefficients are shown in Table 9. None of these correlations are significant. This suggests that this study assessed seven distinct constructs.

Table 9. *Correlations (Spearman’s ρ) among ratings, pooled across the three groups.*

	Authoritative	Insecure	Friendly	Fake	Gay	Like to listen	Unpleasant
Authoritative	1.000	-0.010	-0.011	-0.044	0.048	-0.016	-0.063

Insecure	-0.010	1.000	0.034	0.033	-0.041	0.045	-0.026
Friendly	-0.011	0.034	1.000	0.019	-0.021	0.058	-0.011
Fake	-0.044	0.033	0.019	1.000	0.020	-0.008	0.023
Gay	0.048	-0.041	-0.021	0.020	1.000	0.019	0.006
Like to listen	-0.016	0.045	0.058	-0.008	0.019	1.000	-0.028
Un-pleasant	-0.063	-0.026	-0.011	0.023	0.006	-0.028	1.000

Two additional pieces of data were collected that are not analyzed here. After responding to the seven agreement questions, individuals were given the option of providing up to three additional descriptors of these people’s voices. Of the 199 listeners, 39 provided no responses to this question, and 37 provided an average of 1 response per stimulus. Six individuals (5 CHM, 1 CHF) provided three attributes for each stimulus. There was a slightly higher average response for the GSE group (0.59) than the other two groups (0.52 for both). The nature of the responses themselves were highly varied. Though it is outside of the scope of this thesis to analyze all 6,414 of these responses, they were by and large positive (*confident, humorous, caring*). Indeed, the single most common attribute was *friendly*. Some appeared to be intentionally humorous (*saw the movie Airplane in the theater and loves to tell teenagers that they would be “offended” if they watched it today; Spent 2021 trying to get you into NFTs; Actor in a terribly directed B-Movie, such as Birdemic*). Twenty-one of the ratings mentioned artificial intelligence and 68 mentioned fakeness, perhaps suggesting that the listeners realized that the stimuli had been

manipulated acoustically. A very small number of comments referenced acoustic manipulation directly (*sounds pitch-shifted*).

These data are evidence of the deep engagement of the participants with the task. They illustrate the many pieces of information that speech conveys, and the greatly varying engagement with the task among the participants. Further evidence of the latter came from an optional, open-ended question at the end of the experiment, in which participants were asked to share any reflections they had on the experience of participating. Of the 199 participants, 125 answered this question. As with the data in the previous paragraph, a full analysis of these are outside of the scope of this thesis. Some individuals commented that sentence-length stimuli were not sufficiently long to judge attributes like authoritativeness. Some people reflected on the prior knowledge they brought to the experiment and the socioemotional aspects of participating (*"This wasn't an easy task for me. I don't have a lot of personal experiences interacting with different sexes/genders so I had to rely 100% on my gut. I probably relied too [heavily] on stereotypes as well. I do like the fact that it allows for reflection"; "The experiment was very interesting. I didn't realize you instinctively could form so much of an opinion on someone just based on their voice. Thank you for allowing me to participate"; "This experiment made me reflect on how I sound to others, since I only know how I sound through my own head. As a trans man, I am always conscious of how I speak, and sometimes, for example in customer service situations, I tend to raise my voice higher out of habit. It's hard to break that habit and train myself otherwise. I hope that this study can be used to help fellow trans people to sound in a way that is affirming to them :) Thanks for letting me participate!"*).

These data are meaningful because they show the great variation in prior knowledge, experience, and beliefs among the 199 individuals. As described in the introduction, research like

this study is notable because it examines aspects of language that are *not* shared by a language community. In such work, it is critical to at least give participants the opportunity to describe the experience of participating, as these answers can guide future work on this topic, and how this information is disseminated to the public (i.e., being sensitive to the very different reactions that people have to this work).

In sum, the data collected as part of Objective 3 revealed many interesting patterns. In general, people in the GSE group appraised speech more positively than people in the CHF and CHM groups in many dimensions. The mixed-effects regressions showed that aVTL was a much stronger predictor of ratings than f0. Indeed, f0 rarely predicted responses to the agreement questions, despite there being a wide range of f0 in the stimuli. In general, however, the results of Objective 3 suggest that there is too much variation among listeners to use these ratings as anything more than a general guide of how a particular voice might be appraised. The variability evident in the data is far greater than the discussion in this section would allow. For example, 20 listeners consistently answered ‘no’ to the Cis/Trans question, and 20 participants answered ‘no’ for ten or fewer stimuli. There are many, varied potential reasons for this variation, from fear of getting an answer incorrect to ideologies about language and gender. Eight individuals gave 50 or more responses of 3 (indicating maximum uncertainty) to the question about whether voices sounded gay, while 25 individuals gave no such responses. These and other facts illustrate the great variation in voice perception in the population. This finding could be used proactively in counseling individuals receiving gender-affirming voice services: since individual reactions to voices are so varied, clinicians would be wise to re-center the client’s needs by addressing qualities that create ‘phonetic dysphoria’, rather than focusing on achieving a voice that will be perceived a particular way.

Objective 4: Qualitative Experiences of Transmasculine People

Objective 4 examined the perceptions of a small set of individuals on an in-person version of the experiment described in Objective 3. Importantly, these participants also took part in a qualitative interview about gender and speech. Because all of the participants were transmasculine, these discussions focused on important information about their experiences with vocal transition.

Methods.

Participants. Those who were contacted for the listening experiment were almost exclusively those who filled out the interest form 4 months prior and were eligible for the second portion, but not the first. As such, these participants were recruited from the same Twin Cities queer community group and Twin Cities arts group, with an additional 3 interested parties contacted from outside these groups because they expressed interest in the project by word of mouth. A total of 35 people were contacted, and 14 sessions were completed. 3 people were contacted who did not fill out the original survey 4 months prior, as they had expressed interest outside of that space. Of the 14 participants who completed this section of the study, all identified as transmasculine in some capacity. Table 10 summarizes demographic information of the 14 participants. Though testosterone status was not asked about directly, most participants volunteered that information, and hence it is included.

Table 10. *Demographic information for participants in Objective 4.*

ID	Gender Identity	Pronouns	Age	Race/ Ethnicity	Sexual and/or Romantic Orientation	Testosterone status
101	Trans male	Not given	22	White	Bi	1.5 years
102	Non-binary transmasculine	They/them	27	White	Queer	9 months
103	Trans masculine, non-binary	He/they	25	Latinx	Queer	7 years
104	Agender/ non-binary transmasculine person	He/they	26	White	Queer	5 years inconsistently, past 1 year consistently
105	Transmasculine bigender	They/he	23	White	Women	Not on T, starting soon
106	Transsexual	Any	24	White	Gay, queer	3-4 years

107	Genderfluid, butch dyke, transmasculine, gender non-conforming, non-binary	They/she	28	White	Queer, bi	Not on T
108	Trans man	He/him	32	White	Queer	5 years
109	Man	He/him	43	White	Gay	15 years
110	Transgender man with feelings of not fitting into the binary	He/him	25	White	Bisexual	1.5 years
111	Non-binary, transmasculine, genderqueer	They/he	31	White	Queer	On T
112	Non-binary, transmasculine, masculine and feminine simultaneously	They/them	29	Biologically white, culturally Native	Non-binary lesbian	On low dose of T for past 2 months

113	Genderqueer, non-binary	They/he/ze	24	White and Jewish	Bisexual	1.5 years
114	Non-binary transmasculine, genderqueer, gender non-conforming, trans man/person	They/them	26	White	Bi and queer	3 years

Procedures. One of the four experiment versions from Objective 3 was used for Objective 4, given that there were fewer participants. This experiment was programmed in E-Prime 3.0 instead of Qualtrics, and hence the interface looked slightly different than that in Objective 3. For in-person transgender participants, two more questions were added to the ‘agreement’ section of the experiment: *This person’s voice sounds like mine* and *I want to sound like this person*. These questions were included in order to encourage the in-person participants to reflect on their reactions, patterns to their answers, and their personal relationships to their voices in anticipation of the sociolinguistic interview that took place after the experiment. More importantly, however, the response choices were different from those in Objective 3. In Objective 4, the participants were asked the truth value of the statements, rather than their agreement. Four levels of response were provided: *Not at all true* (coded as 1), *Somewhat true* (2), *Mostly true* (3), and *Completely true* (4). The choice to use a different response scale was motivated in part by the formative nature of this work. We reasoned that a truth-value scale might elicit more general discussions in the open-ended interview than an agreement scale. The

truth-value scale asks about broader principles, while the agreement scale asks about personal opinions. Another minor difference from the Objective 3 experiment was that the Objective 4 experiment allowed for blank responses.

Upon arrival at the lab, informed consent was obtained and participants were invited to a recording booth to complete the 60 minute experiment on their own using headphones and a computer, with the student investigator nearby to answer any questions. Following the experiment, participants partook in a semi-structured interview/conversation with the student investigator about their reactions to the experiment. Interview questions were not set ahead of time, though reactions to the experiment and relationship to the participant's own voice were covered in every interview.

Results

Experimental Ratings. The analysis of the experimental ratings parallels that of the same ratings for Objective 3. There was a strikingly higher proportion of 'yes' responses to the age question (0.84) than in any of the on-line participants. For the gender question, only 8.4% of the responses were 'no', 16.4% of 'Yes (female)' responses, 60% of 'Yes (male)' responses, and 9.2% of 'Yes (other)' responses. These are again strikingly different from all three groups of on-line participants. For the Cis/trans question, there were 9.5% of 'no' responses, 12.3% of 'Yes (Cisgender woman)' responses, 4.8% of 'Yes (Transgender woman)' responses, 44.3% of 'Yes (Cisgender man)' responses, 23% of 'Yes (Trans man)' responses, 3.2% of 'Yes (Non-Binary)' responses, and 2.9% of 'Yes (Other)' responses. Again, these are strikingly different from all three groups of on-line participants. Together, these answers suggest greater confidence (as evidenced by fewer 'no' answers), and many more identifications of trans men. This finding may be due to the capacious definition of 'GSE' used in Objective 3. Individuals in that group were

defined by not being cisgender, heterosexual, or both. Individuals in Objective 4 were more narrowly defined as transmasculine (including trans men and non-binary transmasculine folks). The higher identification of voices as transmasculine sounding might reflect in-group biases. The overall lower ‘no’ responses, however, may reflect the different social circumstances of on-line and in-person participation. On-line participation is entirely anonymous, and hence there is no social cost to responding a particular way. In-person participation is not anonymous. Reticence to answer ‘no’ might reflect a perceived stigma associated with giving an answer that might be perceived as incorrect or not showing commitment.

Table 11. *Proportion of responses to the nine agreement questions for Objective 4.*

Question	Answer				
	Not at all True	Somewhat True	Mostly True	Completely True	(Blank)
This person’s voice sounds authoritative	0.201	0.288	0.410	0.100	0.001
This person’s voice sounds insecure	0.551	0.292	0.124	0.030	0.004
This person’s voice sounds friendly	0.026	0.230	0.470	0.274	0.000
This person’s voice sounds fake	0.748	0.161	0.064	0.027	0.000
This person’s voice sounds gay	0.283	0.392	0.200	0.125	0.000
I like listening to this person talk	0.067	0.292	0.423	0.219	0.000
This person’s voice is unpleasant to listen to	0.729	0.198	0.061	0.013	0.000

This person’s voice sounds like mine	0.552	0.343	0.061	0.044	0.000
I want to sound like this person	0.445	0.242	0.218	0.095	0.000

Table 11 shows that the participants' responses generally rejected negative labels about fakeness, insecurity, and unpleasantness. Interestingly, participants also indicated that the voices overwhelmingly did not sound like their own voices. Clearly, many more analyses and interpretations of these data than is possible in this first write-up. One interesting aspect of these ratings is that they were much more highly correlated with one another than the analogous ratings were in Objective 3. For example, there was a significant, positive correlation between fakeness and unpleasantness ratings ($r=0.53$), and a significant positive correlation between ‘like listening’ and ‘want to sound’ ratings ($r=0.52$).

One of the overarching goals of this project is to introduce agency in selecting treatment targets for gender-affirming voice services. To this end, we examined variation in responses to the final question, *I want to sound like this person*, as they relate to the acoustic characteristics of the stimuli. Figures 11, 12, and 13 illustrate three different patterns of responses for this question. The remaining 9 responses to *I want to sound like this person* are included in Appendix 3.

Figure 11. Responses to the Question 'I want to sound like this person' by Participant 104

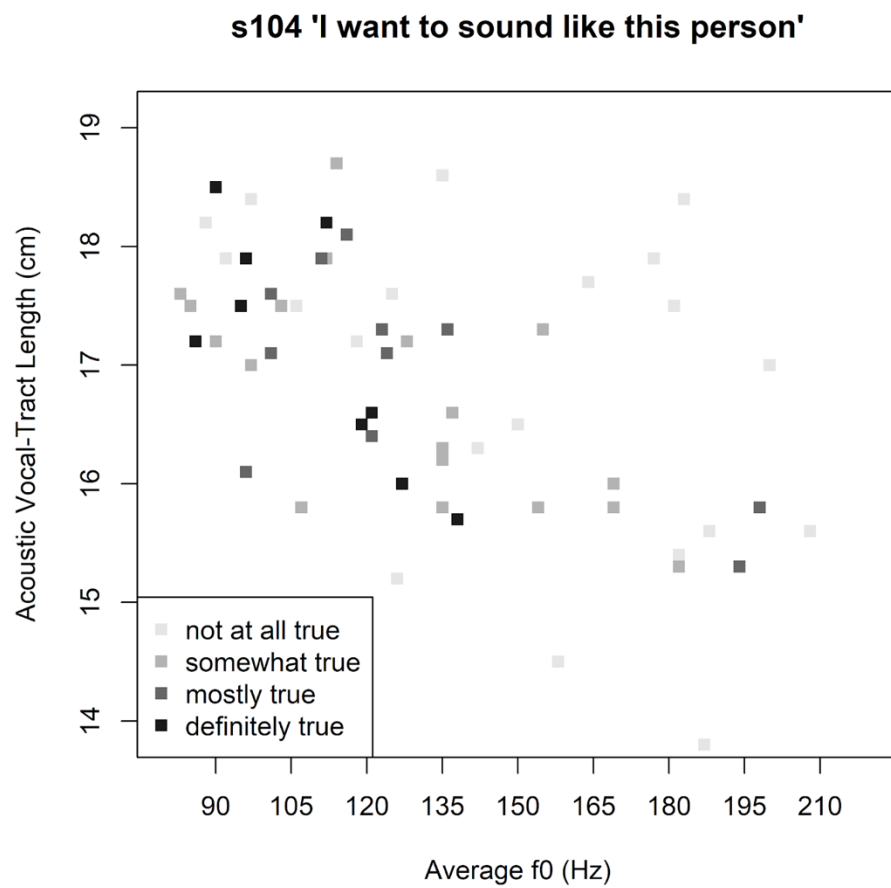


Figure 12. Responses to the Question 'I want to sound like this person' by participant 106

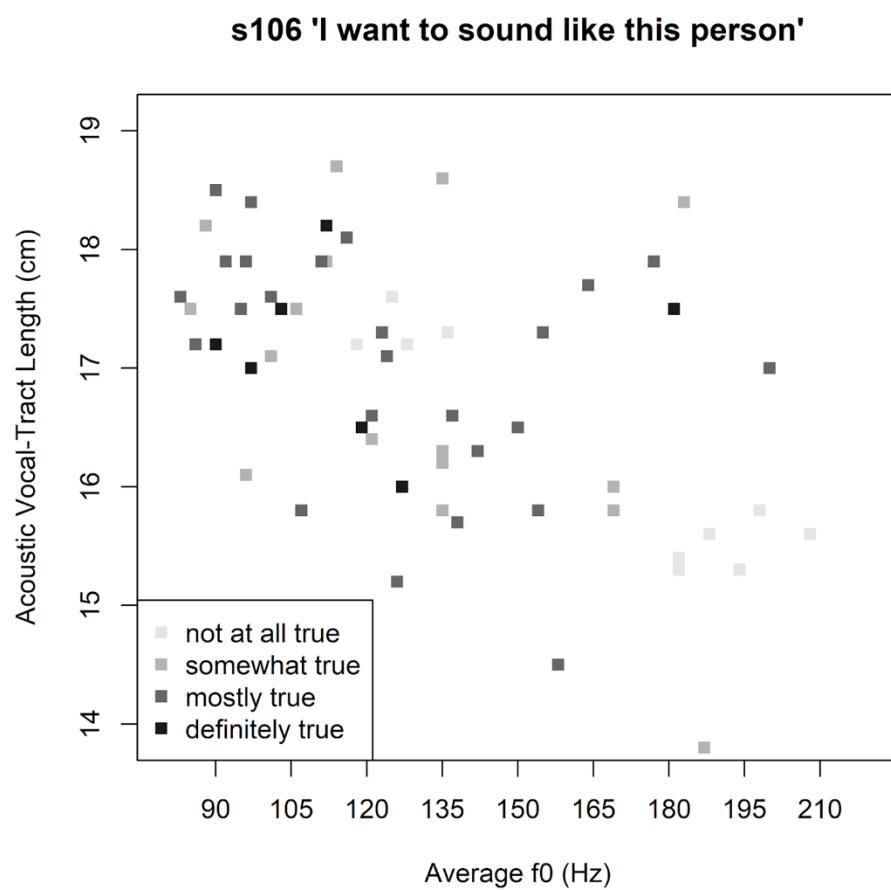
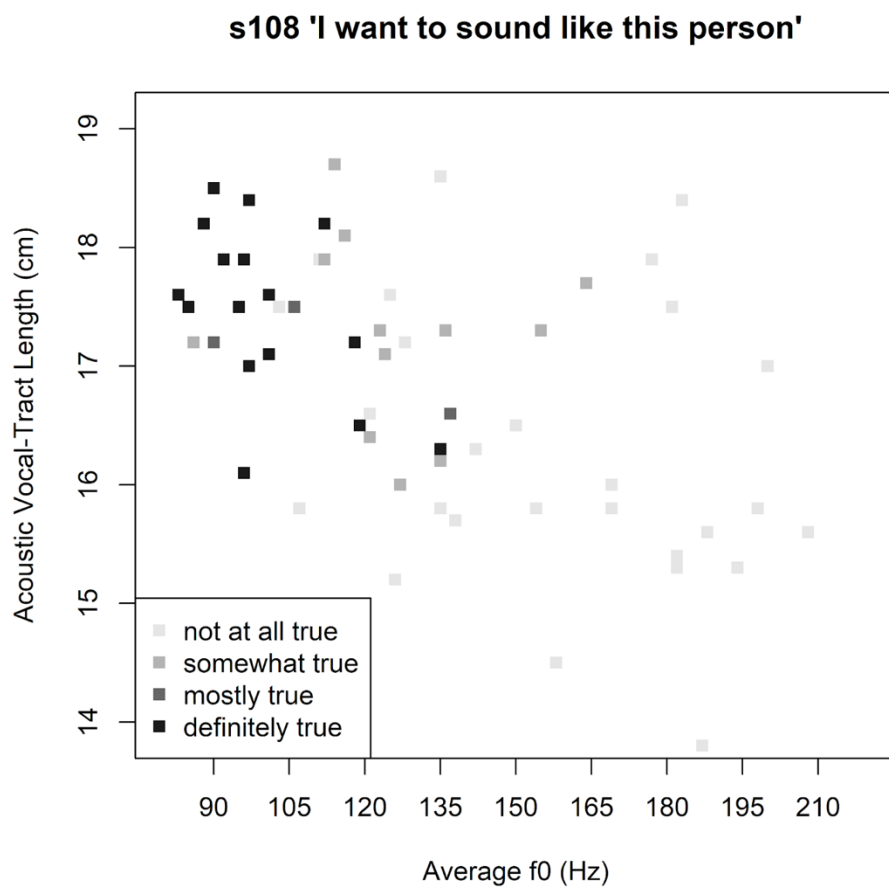


Figure 13. Responses to the Question 'I want to sound like this person' by Participant 108



These figures show very different patterns of responses. The responses of participant 108 can be characterized broadly as matching the way that gender-affirming voice services have been provided to transmacline people historically, focusing on low f_0 and a high, 'long-sounding'

aVTL. Participants 104 and 108 show a very different pattern of responses, with values that span a wide range of f0 and aVTL. These findings emphasize the importance of not assuming that transmasculine men desire a monolithic ‘male’ voice. The patterns of responses for 104 and 106 are less straightforward to interpret. One interpretation is that these individuals’ desired voices are not static, but instead encompass many different ways of speaking, perhaps to different audiences and different contexts. Alternatively, they may represent a preference for a way of speaking that is not captured by aVTL and f0.

Interviews. The interviews were transcribed by 3 undergraduate volunteers in the University of Minnesota Studies of Applied Sociolinguistics of Speech and Language (SASS) Lab who had specified interest in work focused on transgender speakers. A variety of themes were extracted from these interviews. Thematic coding was conducted solely by the student researcher by reviewing all responses and selecting topics that multiple participants spoke about with respect to Braun and Clarke's (2006) thematic analysis protocol. The themes and supporting statements are provided below. The quotes provided in each theme are snippets extracted from approximately 4 hours of conversations with participants; Appendix 2 contains comprehensive responses on each topic.

Theme 1: In-depth descriptions of gender identity. While every participant gave one or more labels to describe their gender identity, some described in greater detail how they experience their gender. Statements that fell under this theme are listed below. The number after each quote refers to the participant ID, as shown in Table 10.

- “I wanna have the option [to sound trans]. I wanna have the option of taking off a dress and being a man in the eyes of the beholder.” (Participant 111)

- “If somebody said, ‘are you a man?’ I’d say no. ‘Are you a woman?’ I’d say no. If somebody asked, ‘are you a man and a woman simultaneously?’ I’d be like, sure. So, I only exist as both or as neither and I am gender fluid in that kind of way of doing it and expression. So, it’s, it’s that fun level of like, if you can see me as both simultaneously, awesome! Cus I am definitely somebody who has more of a –.excess of gender rather than an absence of gender, although I do feel absence of gender occasionally. Usually, I’m feeling more of an overwhelming amount of masculinity and femininity simultaneously.” (Participant 112)

Theme 2: Identifying qualities about a person based on their voice. Participants were asked about their reactions to the experiment, or any patterns that they noticed in their responses regarding qualities that they identified in the speakers’ voices. Of the questions asked in the experiment, participants had possibly the most difficult time with identifying the speaker’s ages. Many felt they were guessing around their own age for almost every participant:

- “Most of the ages I felt like were twenties and thirties and I’m 32 and so, if I did this experiment, like twenty years from now and I say like, ‘forties and fifties?’ [Laughs]” (Participant 108)

Another participant frequently heard the voices and thought of someone that he knew with a similar voice, then guessed the speaker’s age based on the age of his friend:

- “If it was just a voice that sounded like someone I know and that person is 30, then I’m just like ‘oh, that could be a 30 year old.’ So, like, at the beginning I was kind of like 30 and then after a while I was thinking and I was just, like, I have no idea. This is just, like, a random person is popping into my head and I’m using that person’s age but for no other reason than those voices sounded similar to me. And so, towards the end I was just like I

have no idea. Like, this person could be 12. Well, okay, maybe not 12. This person could be 18 or they could be, like, 60.” (Participant 109)

When asked about qualities of the voice that indicate a speaker’s age, participant 102 said that they thought older voices sounded raspier, as though they could hear the wear and tear from time. Participant 109 also brought up menopausal changes:

- “Some of the more feminine, like, higher range I don’t even know if I’d say feminine but higher range voices, they were a little on the lower side though, like, made me think more like an older woman who’s maybe gone through menopause.” (Participant 109)

Participants were asked whether the voices sound authoritative or insecure, which most felt more confident in identifying than age. While gender did come up in these conversations, which will be discussed later, some qualities that are independent from gender came up as well:

- “An authoritative voice is one that takes its time. To, like, say something and I think an insecure voice rushes through things because they’re insecure that people won’t listen to everything that they have to say.” (Participant 107)
- “I struggled with, uh, the authoritarian label. I just thought to myself, ‘does this person sound like, they sound like, they know what they’re talking about?’ Because most of the people – I don’t think there’s anyone who struck me as, like, like a dickwad, that would like, tell you like – [Laughter], ‘you must obey traffic laws!’ Or something. Like, [Laughter], that’s authoritarian to me.” (Participant 114)

One participant framed it from a lens of qualities they find attractive in others:

- “My type is, like, even for, like, trans people is, like, masculine. I’m attracted to masculinity. Um, in all different forms. For some reason, a deeper voice I’m associating in my brain with masculinity. I just feel like there’s a confidence. There’s like a, oh

there's, like, a confidence like, 'oh I've never ever ever been oppressed. Or challenged in my life. Like everything I say, like, people listen to.' Um, there's not a struggle in that voice. And there's an ease too. And maybe that's actually what's most attractive is the ease. And there were some people [in the listening experiment] where I was like, oh, this person isn't, like, a cis man and has that ease. And I was like, that's an authoritative voice to me." (Participant 107)

Theme 3: Identifying gender based on voice alone. More than half of the interviewees brought up discomfort surrounding gendering people at all. Several participants stated that they did it for the sake of the research study, but they did not enjoy doing so. A paragon of this discomfort was voiced by Participant 107:

- "I, like, totally am aware of these things. I studied acting and so I've studied speech and voice. I am always tuned in to people's voices. And it just felt, I don't know – it's like, it is weird to be like, 'yeah I feel like I could tell that's a trans man,' you know? And so that just felt like – I was like, that doesn't feel good to, like, out – It felt weird to out someone even though I was, like, in a [private space] and no one could say, you know? So that was yeah, kinda yucky." (Participant 107)

Many participants firmly believed that any person can have any voice, based on their experiences in the trans community. One participant, notably the oldest of the group, figured he would have no problem identifying gender based on voice:

- "It was a lot harder than I thought it was going to be going in, like, I really thought I'd be like [snaps finger] trans masculine [snaps finger] trans feminine, cis man. But it was actually really hard, like, especially when I just, like, started thinking about it. I was like, well, this could be a woman or it could be a trans masculine person who's not on T. Like,

how do you know? So, I found myself just kind of like, for the most part, at least with, like, the voices that I didn't, like, feel were trans in any way, just kind of going with, like, this is probably what a woman would sound like, so I'm gonna say this is a woman who's cis. And the same for men. It was really hard, like, in the middle voices. (Participant 109)

A few participants explained their rationales for thinking a speaker was a woman:

- “A couple people I could tell with like, it's almost – and this isn't necessarily a bad thing – I just think it's the gender binaries of the world we live in – to some extent is, having more uh, insecurities, is something that tends to be either assumed to be for, more feminine voices so, there was a higher chance someone was feminine had that I would assume that they were at least transfem or a woman or somewhere in that capacity based on that aspect. Because that tends to be something that is a desirable aspect of femininity, versus that not of a more masculine aspect of the voice. Customer service voice, we've all, like I, I, the amount of training I had to do to get, to come out of that also, kinda reminded me of those different aspects.” (Participant 112)
- “Honestly, most of my friends are, are women and most of the people I know are women. Uh, before I started T almost exactly three years ago, um most, the majority of the women in my life had deeper voices than me. So I kept that in mind also, like, just cuz I hear a voice that's maybe a little bit deeper, like, doesn't mean they're not a woman.” (Participant 114)

Theme 4: Identifying transness based on voice alone. As part of the experiment, participants were asked if they could determine whether a speaker was cis or trans based on their voice. Some participants relied on their gut reactions to tell them whether they were correctly

identifying transmasculine voices, and felt very confident in their answers due to their own personal experiences, inside or outside of the study:

- “ [I can tell because of] my experiences talking to so many people on T. And like, some sort of gut – Like being able to tell most of the time and be right if someone is on T.” 106
- “If you’re used to speaking from, um, a higher pitch vocal cords, like, like, your, your air is going to be positioned – I don’t – do you know what I’m talking about? Usually, I just feel like I know, and they know also. [Laughter].” (Participant 114)
- “There were definitely, like some where like I could hear like, potentially the change in someone's voice if – whether they were going through puberty for the first time or if they were going – if they were on testosterone for a second puberty, um like, you could hear some of the changes cuz I’ve also been through those changes.” (Participant 102)

One told a story of a time that he assumed a voice he heard came from a trans person, which he was reminded of when asked to determine whether the voices belonged to trans people:

- “I heard a kid once – like, in the skyway – and I was like, ‘oh, you must be a trans guy!’ and I turned around, and he was, like, a fourteen-year-old boy! [Laughter]” (Participant 108)

Some felt less confident in identifying trans voices:

- “I could hear a voice and I was like, oh, this voice is like, it’s like – I can tell that it’s like a funky voice in a gender way, but like I couldn’t always tell in which direction, or at what, like, time of life. Like, there was just a lot of – I was like, something is going on, but I can’t – without like, the rest of the presentation, I can’t always like pinpoint. So that was like, that’s something else I was investigating in my own reaction too. . . I couldn’t

necessarily say, like, if they were like a man or not, but other voices, I could, like, immediately tell that like, this is person is on T.” (Participant 106)

- “It’s interesting cuz there was still sort of that same trans voice in there, but it was maybe a little different, but I wasn’t super confident about it. At all. Like, it’s kind of, like, um, they’re all kind of, all of the trans voices seem to be, like, in the same range and it was, like, really nitpicky to try to, like, put them in a box, whether it was trans feminine or trans masculine. I don’t feel like I did a great job of it, like, if I were to be like how many did I actually identify?” (Participant 109)

Others felt they could identify a trans voice based on the speaker’s perceived attentiveness to their voice:

- “It’s almost like there’s, like, a strain in the voice, I don’t know. A consciousness of the voice.” (Participant 109)
- “Sometimes I had, ‘this person is giving trans. I don’t know which trans.’ I had that a couple different times and just like, I can tell just different aspects of this seems, like, you’re really thinking about how you’re saying things. And some of that could also be an aspect of being in a study; maybe some people think more attentively when they’re doing it? But there is, for a lack of a better a way to put, I can feel the effort behind some of it? Or the amount of like, thought that goes into it. And some of it could also be, I mean, the variables there are, is somebody, you know, professionally trained and doing that? Are they professionally, you know, in theatre, or other things that would make them be incredibly useful to practicing how they’re speaking on a regular basis or stuff like that?” (Participant 112)

Some listeners discussed the qualities that they identified in voices they perceived as transfeminine. None of the speakers in the experiment identified as transfeminine, however it is important to note that listeners were given acoustically manipulated samples.

- “Trans women I usually can almost tell because it’s almost like, I can feel that you’re going the opposite direction, and I support you and I love you, but I don’t wanna sound like that! Cuz although there are different things that I can tell that are happening that I am intentionally either trying not to do or trying to lessen.” (Participant 112)
- “I think for me, the trans woman voice tends to be smoother and, like, you can hear more of them pitching up from maybe, like, their base voice. Whereas trans-man-voice feels like they’re pitching downwards. Um, definitely a difference in, like, where they’re projecting from too to my ear. Like, I feel like, almost always, like that nasally sound is – cuz it’s still up in the front of the, like, voice head thing, whatever, head voice. Because it’s, like, what you use as a cis woman and then the trans woman voice is more lower from the chest, because that’s what you’d be used to using. And that sounds like I’m more knowledgeable than I am but, like, that’s how I kind of hear it.” (Participant 113)

Others brought up the way that identifying trans voices made them reflect on their own voice:

- “Most of the people who I thought sounded like me, I did assume they were trans, but I didn’t – I didn’t always assume they were transmasculine. there were some people who I assumed were cis women who I thought I sounded like, and that somehow made me more uncomfortable.” (Participant 104)
- “For the longest time, I was just pushing my own voice down. You know? A step or two, to the point where I could. So, that’s definitely something that I tend to associate in that area and also tend to differentiate.” (Participant 112)

- “Definitely I’m more critical of, um, anyone's voice who might sound like a trans man because I think on a – well, I wouldn’t say critical. I would say, attentive! Because I wanna know who the other trans men are! Enter my world! Right? Like, if they’re my pharmacist. [laughter]. Like I was saying, like, we pick up on each other for a purpose. For a reason, honestly.” (Participant 114)

Theme 5: Qualities of the ‘T-voice’. Many participants brought up the distinctive sound quality of a transmasculine voice which has changed due to starting Hormone Replacement Therapy (Testosterone, or “T”) after already experiencing an estrogen-dominant puberty. In the trans community, this voice is known as “T-voice.” When asked to describe the qualities of T-voice, 3 participants said “raspy,” 4 said “nasally,” 2 said “gravelly,” and 1 each said “buzzy,” “tinny,” and “pebbly.” A few participants also identified qualities in a transmasculine voice that may not necessarily come from taking Testosterone:

- “[Transmasculine people] dip their voice. You can tell they’re trying to make their voice lower – and it sounds fine, but you can notice it.” (Participant 103)
- “I think that [the trans vocal quality] exists more often for transmasculine people who have taken testosterone, but also think that transmasculine people who are intentionally modifying their voices usually end up having some amount of that as well.” (Participant 104)

One listener astutely described their own experience with T-voice, and how their relationship to it has changed:

- “This is getting into my own philosophical beliefs too, but I do feel like, like a T [voice] like generally like – particularly transexual voices, like, occupy a lot of like spaces and times at the same – like, dimensions – like, in the same ways. So, like, we’re like, it

sounds like, sounds like a pubescent child and then also sounds like – like there are like moments where it sounds like a resonant man, and then also it like sound like super fag-y, and then also sounds like super like, maternal even. There’s just like – I feel like there’s a lot of – it’s special. And silly! And – I was like, afraid before I was a part of it. Because I was like, I don’t want my voice to sound that way! I don’t want to sound like a pubescent boy forever. And then it started happening to me and I was like, oh, this is kinda cute!”

(Participant 106)

Theme 6: Passing, ‘clockability’, and the voice as a gendering factor. When discussing qualities of the T-voice, several participants brought up its significance in determining that other people are trans in social situations. Detection of other trans folks serves as a beacon of safety for those with shared identities:

- “I think this is a semi-universal trans thing: we evaluate other people’s voices to clock who they are. Um, like, you know, oh, we’re checking out at Target and this employee says words to us and we walk away – trans. And it’s, you know, part it’s, like, self-preservation of, like, I find you my safe people. But also, it’s like because I have spent so much time thinking about this I can tell – even if I don’t know that I can tell – the inflection that you used on this word is not normal. It’s one of those identity crisis kind of things.” (Participant 111)

In the trans community, a voice that immediately reveals to the listener the trans identity of the speaker is known as a “clockable” voice. As in, one can “clock” that a person is trans based on the sound of their voice. On the other hand, a voice that “passes” is one that may not signal to the listener that the speaker is trans; as in, someone who “passes” as a cis man. Several participants explored the clockability of their own voices:

- I do sometimes, um, feel bothered still by, like, how much it cracks or just how, like, kind of still – like, I feel like I have a bit of a clock-y voice. Um, which is like, sometimes I’m totally fine with, and other times I, like, ‘why do I sound like a 13-year-old boy when I’m an adult?’ um [laughter] so that’s something that does bother me sometimes. Um, but, and I – it’s something that I also try to be conscious of and most of the time uh try to, like, modulate my voice down a little bit.” (Participant 106)
- “Something I’ve noticed – and I know that this is true for a lot of my friends who are on T who I’ve talked to about this – that, um, sort of when we’re, like, more chill or thinking about it we can like really pass or go super low and then when we’re like excited, or like, more comfortable or more uncomfortable like both like kind of equally, then we’ll get into like a higher, like, cracklier place. Um so I don’t know if I – that doesn’t bother me as much as it used to, I think it also doesn’t happen as much as it used to.” (Participant 106)

Others brought up their relationship to passing:

- “I want to be expressive and I think I do have like, pride in my identity, and like one thing I thought about is like, um, I thought about, I think my first gut reaction when I thought about how I wanted my voice to sound – and I was just asking my questions while I was thinking about the study – is like, uh, do I want people to like recognize me as like, like, gay or queer, like, and I’m like, ‘hell, yeah!’ And then, like, and I thought, ‘well do I want people to clock me as trans?’ And I was like, [sighs], like, and like, I felt my gut reaction was like, ‘no, my business, thanks.’ But then I’m like, ‘why do I feel more comfortable with people knowing that I’m queer than I do with people being trans?’ it’s like, I mean, you can look at like, [laughs] all the anti-trans legislation going on right

now and I feel like, well and I feel like part of that too is like, if people found out you're gay, like, they can't be like, 'oh, you're not gay. Or, you should – like, whatever.' They can't change your pronoun based on your sexual orientation. Or, like, I guess they can to be like, diminutive, but like, I feel like if people clock that you're trans then they like, will change how, I feel like they'll be more likely to change how they treat you – like, assume they know you better.” (Participant 110)

- “I was pretty happy with how my voice sounded the first, like, year and a half. You get a little impatient, but I also, um, took a smaller dose than I, I could have, of T cuz I was a little cautious about some things at first, and the pandemic was going on, and my life was crazy enough and whatever. Uh, and, um, but I've become more unhappy now that it's been three years and I still don't pass, like, ever. And that sucks. I, I think I'd be a lot more happy with my voice if I just passed cuz that was like, a big goal of mine. And for me, like, when I hear my voice on video, I'm like, oh it's so different than it used to be.” (Participant 114)

A few folks commented broadly on how their voice contributes to the way they get gendered in their everyday lives:

- “The main thing is – and I recognize that my voice is like, always gonna be in the context of my body, so I don't know if my voice is the reason people misgender me a lot. I will say, like, if I go anywhere, like I, I was about to say even if I don't have stubble, but sometimes even if I just like, clearly have like, stubble on my face um, and I'm binding like, I will, I will still get misgendered. And I've tried to be, 'is it my hips? Is it my voice?' I don't know. Um, so as much as there's part of me that's like, 'oh, well maybe if I just like, trained my voice this certain way, um, then maybe that wouldn't happen

anymore.’ I know, probably not. Um, I will also say that I think, um, I don’t think my, like the equipment I have I think I could probably make sounds that people would misgender – but I think because I had a history of customer service um, before I transitioned on top of yeah, being socialized feminine and feeling like super anxious – I will notice like, um, in, in professional settings when I get a phone call, I will jump back into customer service voice, [imitates answering the phone] ‘how can I help you?’ Uh, and that sounds very different from how this sounds and um, probably contributes to the problem and then I’ll like, catch myself doing it. So I’ll be like, ‘Hi! I’m [name], [lowers voice] how can I help you?’ [Laughter]” (Participant 110)

- “I do not pass like, Starbucks drive-thru, on the phone, etc. Uh, so, and so, I, I don’t – I feel like most people either think I sound like a cis woman and other trans men sometimes identify me as like, a trans masc person, but um, I had a really high-pitched voice before I started T so it’s like uh, I’m kind of like, middle of the road. And um, so, I don’t know like, I don’t know if it takes on more trans or less trans in some instances. Probably if I deepen my voice, I don’t think I would sound like a, deliberately, like, if I was kind of dainty or something and I was like, ‘I’m gonna read this script specifically’ like, and it’s, it’s from like a man or something, [Laughter] so I’m gonna deliberately think about how I sound in this moment. Um, uh, I think I would sound more trans because I would sound less like a cis woman, but I don’t think I’m capable of sounding like a cis man. But, I think most of the time I don’t put that much mental effort into it. However, the gay thing is like, totally – however sometimes I do that around women too, and I feel I do that around women to be like, ‘I’m gay, not a woman.’ You know? ‘Please don’t include me in girls club.’” (Participant 114)

- “It’s frustrating to me when other people gender me based on my voice especially over the phone. It’s, like, the worst thing in the world. I don’t know why because I don’t care that much in person, but yeah. So, I’m very, like, caring towards my voice. I like it but it’s definitely, like, ever changing and that’s kind of scary at the same time. But I’m finally, like, I think my talking voice naturally is finally, like, the right kind of range that I wanna be in.” (Participant 113)

Others described ways that they code switch, or change the way they speak depending on the environment that they’re in:

- “[At work] I mimic [my women coworkers’] speaking tones. So, cuz I also, like, I don’t wanna sound, especially right now, where I am in my career, I’m very much in training, so I don’t want to sound like a cocky asshole guy, kind of man. So, I think I manage my tone and reflection and um, to like, mimic their voices. But also, you know, when I learned to speak, I learned to speak with women. Like, I learned to inflect as a woman and so, I think it’s just a natural habit that keeps coming back too. You know, it’s twenty-six years versus six years now.” (Participant 108)
- “I do feel like I code switch in a way, like when I’m talking to men or like, masc folks. Like, I just talk however I talk, and then with, like, women or like fems I play it up a little bit so I’m like not a dangerous person. [In order to do that] my pitch goes up. I try to have, like, a happier tone I guess. Or just like, try to make myself sound as gay as possible. Like I’m not a threat. Like, I use more hand movements, um, I’ll do like the limp wrist thing and try to make myself, like, smaller too. Yeah, take up less space.” (Participant 103)

- “I think I'm always going to have a higher pitch voice when I'm talking to pets or little kids, just because it tends to be what everyone does and also, it's fun, and right now animals like me. I don't want to risk that by sounding like, [laughter], it's like, if I sounded too masculine, they'll be more afraid of me. I can't risk losing that either. So, it's all these different pieces that my brain is trying to balance simultaneously. To be able to have that vocal joy while also not necessarily losing some of the vocal stuff that I currently have.” (Participant 112)

Before Participant 114's session, they called the student investigator for help with parking.

During their interview, they shared their perceptions of the student investigator's voice, and how it affected the way they were feeling about participating in the experiment:

- “When I called you earlier [laughter] and I was like, ‘Oh my god! Yuh!’ You could've been bringing me a Birkin bag because I was so relieved when I heard your voice, because I was like, I'm so glad that, this isn't like, a cis man who's about to like, dissect something about trans people.” (Participant 114)

Theme 7: Identifying gayness based on voice alone. Several participants shared reactions to the experiment question, “does this voice sound gay?” and how they differentiated a “gay voice” from a “trans voice”:

- “Sometimes I was, like, hearing a T- voice and I was like, ‘oh, this is also like gay,’ um, but I think that when I sort of really, really clearly felt like it was a cis male voice that was also gay, um, I was getting, like – I was getting a resonance that I don't get with trans-masculine voices. Um, and sort of like a slower deepness, but then also kind of um like a – (sigh) like a feminine lilt, um that, and I want to say it sort of like vocal fry. But not really? Um, like a more kind of, a lilt, I guess. And, like, maybe like a sort of raise at

the end of the phrases. Um, yeah, I'm trying to remember the voices that I particularly felt like were cis and gay. Um, and I think they tended to be like, deeper but also kind of like, soft spoken, and I think maybe, like, spoke a little slower too." (Participant 106)

- "There's the *beautiful* complication of like, is this cis gay man? Or a transmasculine person who might also be gay? Or in that kind of category – because when you add queerness into that mix from a non-gender standpoint, that deeply complicates everything as well. In a good way!" (Participant 112)

Many also had a clear idea of what a gay voice sounds like for cis men:

- "I can still hear like, the cis, like, like deep, like, bass tone with the larynx – but the, the way they speak it's like, very musical and very like, not, not monotone or like, they go up on their sentences at the end. Or like, you know – very, stereotypical, but, like, musical, I guess? The opposite of monotone." (Participant 108)
- "The lisp, I think. Like, the lisp is one aspect of it. Um, but and I think even some voices where I was like, I don't know, maybe gay, but there's that lisp but maybe not. And I would just kind of, like, went towards gay. But there's also just, like, I feel like gay men especially, like, are a little more, like, up and down with their voice, like more expressive." (Participant 109)
- "I feel like it's the, like, going up at ends of sentences. And there's usually more energy in the voices too. And I feel like the older you get, like, the less energy you have. And kind of, like, that's what my thought process is on that. It just – and usually they're just higher pitched also at the same time, there's, like, a little flourishy sound, like, it's flamboyant." (Participant 113)

One participant shared the thoughts that they have had about this exact question before:

- “For the longest time I wondered like, do you, like, cis, gay men put on the accent on purpose? Like, the uh, gay accent? Or does it just happen naturally? And also, I don’t think it sounds like how women speak, so like, where does it come from? Even though people claim that they are talking more like women and like, I don’t think it sounds like women, but the more I’ve like, my voice has drop down deeper, I’m like, oh, now I sound gay. Whereas before I sounded like a woman, but like, I don’t think women talk like that, but I guess they sound like that if you pitch them down. So, I’m like, I don’t know, so if they sound like me kind of, I guess – and I think I mostly sound gay, and I get gayer if I’m around other gay people.” (Participant 114)

Other participants went with a gut reaction for whether they felt the voice sounded like someone who was safe, friendly, or a member of the queer community:

- “If I felt like their voice sounded gay, I was like, oh this is again like, something that, like, I think also sounds friendly to me. And also sounds, um, like a voice that I would want to listen to. So, I was sort of like that – that’s sort of what came up for me. Where I was like, um, it feels like, it definitely felt like I was coming at it from a particular place of like, certain voices feel better to me than other voices. And that maybe is not like a universal thing. Like certain voices feel better to me because they're like the voices of, like, my people.” (Participant 106)
- “I just kept thinking, like, if this person was my pharmacist, [laughter] like, would I feel like – I know, that you know, that we know, that I know, that you know not to call out that name. [Laughter] You know? [Laughter] So if, or if I was overhearing somebody like, If I was out drawing in public, which I do a lot, and I, I, I, unintentionally eavesdrop a lot because I’m out drawing in public. If I was like, hearing these people, would I be

like, ah thank God, there's other gay people here? Um, just like, overhearing them. Um, [snaps] sometimes I thought about it as a way to like, I, I used to work, uh, fast food and coffee shops where I would like hear them, like, I, I had a lot of experience at being like, this person is blanking, but then they'd come to the window and I'm like, 'ooh!' So sometimes I, in the more difficult ones, I was like, what would I expect to see at the window? Um, cuz, I, I like, am really good at not gendering people so I had to really force myself to like, think about it." (Participant 114)

- "I notice that when I rank like, voices sounded like, like friendly or whatever, it was more like, 'oh hey, I think if I met this person, like, pretty good odds are they wouldn't wanna murder me if they found out my full identity.'" (Participant 110)
- "[I had] some sort of just gut reaction. Like, there was some, like, like very deep like super masculine and/or cis men voices that – and some of them I was like, oh yeah I would love to sound like this and this is like a really beautiful voice! And then others I was like, like this is weird and bad and sound like a man in a way that I don't like. That was something that I was trying to figure out: like which, like why do some of these men sound like safe, and why do other men like not sound safe?" (Participant 106)

Theme 8: Desirable qualities in voices. All participants were asked about patterns that they recognized in voices that they liked or wanted to sound like. In the interviews, 3 participants described desirable voices as "deep," with 1 equating deepness with older age, and the other 2 accompanying "deep" with "smooth" as desirable qualities. Two others specifically identified "lower pitch" as desirable, and 1 brought up their desire for "bass reverberation." One participant identified voices that were "emphatic and warm" as desirable, and 2 others explained that they liked voices that sounded queer.

One participant particularly enjoyed listening to voices they identified as transmasculine:

- “As someone who takes T, like, I feel like transmasculine voices are sometimes kind of like, a little ugly-sounding, but I really love it. And so was this kinda like – I was like, ‘I would love to listen to this person,’ but their voices may be objectively funky.”

(Participant 106)

A few participants went into detail about their experiences in deciding whether a voice was desirable or not:

- “I think there were some voices that, um, that I really liked but I, uh, I didn’t want to sound like. And I think, um, I think that comes from a place of like I, I – so I work in customer service. Like, I, I answer like phones and stuff like that and like, less because it has like anything to do with the quality of voice, like, I would just like to have a voice that is like, ‘ope, nope. You’re a dude.’ I don’t care if people like, like, you know, are able to clock me as like a queer man and I’m just like, I just want to get there [Laughs]. Like, gendered correctly. Um, and that has less to do with the quality of the voice. Um, so I think there are some voices that I really liked listening to and that I would be like, ‘get me an audiobook or a podcast of them, please.’ Um, but I may have, like ranked them lower on how much I wanted them just because I’m like, for, not for the quality of voice but just for like, convenience of my life.” (Participant 110)
- “I take hormones but I’m, I’m pretty all over the place gender-wise. So I was like, ‘do I want my voice to sound like a really deep man’s?’ or like, ‘this is some really beautiful, like, trans voice’ and like, that’s really what I want my voice to sound like, but like – so that was something that I was just sort of, like, investigating. I was like ‘why? Like I think I want my voice to sound like this, but why?’” (Participant 106)

Theme 9: Undesirable qualities in voices. While many people easily procured qualities that they found desirable, far fewer participants were interested in finding qualities that were undesirable to them. This is consistent with the Prolific data, which found that the gender-expansive participants reacted generally more positively to voices than the cisgender participants. Here is an example of a participant's thought process when rating the likability of voices:

- “When I was, like, rating, like, how much you like listening to them, I was like, oh yeah, I’m always doing ‘I would like listening to them’ for all of those voices. And I felt a little bad when I was like, ‘I don’t love listening to this trans voice or, like, possibly trans voice.’ I’m like, sometimes it’s a little grating. Just mean-ish in my opinion but, like, it’s how it is sometimes.” (Participant 113)

One participant explained why sounding gay was undesirable to them:

- “I don’t wanna sound gay. I have been finding more and more that while I identify as non-binary and I am very solid in that, that like, I am not a trans man. I don’t want to be. My ideal, like, back in high school when I was thinking about gender sometimes, was, like, I wanted to be the man in a dress. I wanted you to look at me and think I was a man and then have second thoughts. And I’m starting to sometimes be there. But I know that, like, where I’m at now, I ride this line of – you encounter me and if you have second thoughts, you’re like no, yeah, no that’s not a guy. Um, and so, like, those were the voices that I was like no I don’t wanna sound gay. I don’t want you to listen to me and think, ‘hmm, now what is that?’” (Participant 111)

The only participant without any plans or desire to begin taking T shared their thoughts on their relationship to voice desirability:

- “I love my voice and I worked hard for this voice, so I don’t want to sound like anyone else. And so, like, that makes me think a lot about going on T because I don’t necessarily want a vocal change. Like, I want other aspects of T, but I really don’t want a vocal change because I do like how my voice register is able to, like, get up really high but also be, like, sit kind of lower. Um, and so I don’t want to lose that variance. So that’s why I just answered ‘no’ to every single one. I was like, ‘I don’t wanna change my voice. I don’t want your voice, like, I really like my voice.’ Because I used to not like my voice, and I’ve, like, really worked a lot on it and feel really good about it, where I’m at right now.” (Participant 107)

Theme 10: Participants’ individual relationships to their own voices. Each participant was asked to share about their relationship to their own voice. Four participants identified voice changes as their primary motivator for starting T. Five described feelings of fear surrounding what would happen to their voice when they started T:

- “I think [my fear about going on T] came from a couple of things. I think, I think I knew less people on T before I started T, so I sort of like and most – and most of the people I knew were younger, like earlier on in their transition, um, and I think I had this particular – just from a couple of people – I had this particular T-voice in my head that I felt like was really annoying. Up to, like, the first few months in my transition I still sort of felt it – like, found it annoying – and then I started hearing it change in myself and then, like, something switched and then I was like – I like I started hearing a change in myself, something switched, I think I also started hanging out with more people who were on T and had been on T for much longer, um, and started like being able to really just like recognize when someone was on T. Just like, you know, like, walking on the street, I

could like hear, hear a trans voice and like that sort of like, ‘we are all part of this’
um started feeling really beautiful. Um even though, like, maybe the like, the like
baseline sort of silly qualities of a T voice are still there.” (Participant 106)

- “My identity as a musician, as a singer is – was the number one reason why I did not start testosterone sooner. Um, like, I got a hysterectomy before I started hormones because that was the thing that was important about my dysphoria, um, first. Like, that was the most terrible part. Um, because, like, I remember having conversations with my gender doctor about it. About well, yeah, like, I want to – there are things about testosterone that I want but, like, I’m really scared that this identity that I’ve had my whole life as a singer, that I’m gonna lose my voice. And not have that anymore.” (Participant 111)

Several folks brought forward how they experience their voices after being on T for a while.

Two people voiced that they aren’t sure what their voices actually sound like. Several others brought up alignment of the voice they think they have and the voice that other people hear:

- “I don’t believe that my internal voice is the voice that comes out of my mouth. It’s never occurred to me that, like, I would have any choice in the matter.” (Participant 111)
- “I think I just really didn’t think about [my voice] too much. And like, I absolutely hated hearing any recording of my voice cuz for me it just didn’t match what I thought I should sound like, ever. Um, and since being on T for like 9 months now, I like, I’ve heard the difference in my voice over time and like it’s – the voice in my head and the voice I think other people hear are starting to kinda line up more.” (Participant 102)

Two participants expressed that their voice finally feels settled after being on T for 2 years or more. Others brought up aspects that they are working on shifting, and the uncertainty of those changes:

- “Up until recently where I – even like before 2016, my voice didn’t carry very much but now I’m doing like a shit ton of – sorry – I’m doing a lot of presentations. I mean, it’s fine. I do like a lot of public presentations, um, and I’m still working on, like, my voice carrying. Um, also, like, I picked up mumbling from my dad so like, I’ve been trying to enunciate more . . . I don’t know if there’s ways for me to adjust my voice to a way that I want it to be, you know? Or if it’s just going to be like this.” (Participant 103)
- “My throat feels scratchier easily [now compared to pre-T]. Um, I definitely feel more fatigue, like, I can’t sing nearly as long as I used to be able to. Um, and I can tell, like, sometimes I’m over-projecting also. And like, sometimes that can kinda hurt I guess physically, which is not great.” (Participant 113)
- “It’s hard to not over-scrutinize things that you’ve like, kinda given yourself a free pass to like, via dysphoria for a really long time. It’s hard to just stop that one day when you’ve been like, it’s okay for me to feel like shit about my voice and shit on myself about it, it’s um, you know it doesn’t get better necessarily, um, without work.” (Participant 114)

Theme 11: Singing. While participants spoke with thoughtfulness about their relationships to their speaking voices, most also had nuanced and insightful experiences to share about singing. Participants came mostly from choral, classical, musical theatre, and pop/punk backgrounds. One person shared a story about how a choir director shaped their relationship to their voice:

- “One of the things that was so important about [being in choir] – and, like, I’ve told this story a couple of times – about botching my audition, uh, because I came in having no idea what my voice was. And, so, like, [the director] gave me some alto range, ‘repeat

after me' things and I opened my mouth to do so and croaked. And thought to myself, 'yep and I'm gonna have to audition again in a year when I have some kind of understanding of what my voice is.' And, you know, she was just like, so nonchalant and just, like, skipped down on the piano – was like, 'how about this?' And continued. Yeah. And the fact that, like, that experience could have made or broke my relationship to my voice and music. Like, had I come in to my very first audition and failed like that, I don't know that I would have, like, how long it would have taken me to feel confident enough to try again. If at all. Um, and so, like, I credit [that director] with having given me the power to find my voice.” (Participant 111)

Several participants brought up specific struggles they are experiencing with their voice changes:

- “The things that bother me [about my voice now] are mostly when it comes to singing. Just like, I'm still figuring out how to get some of the control back. I'm still much happier with it than I was when I was singing as an alto, and it feels like I do have more control than I did than cuz I was also in high school at that time. I didn't really have a very developed voice. Um, I think that, in singing at least, it's disappointing to not be able to move between a lower register and a higher register as easily, and having to, like, strengthen vocal muscles and moving between like a chest voice and a head voice is really, really bugging me lately.” (Participant 104)
- I have a muscle memory relationship to my voice and singing. And that, like, I go when I reach for something that I think is there that's not there or has moved. And it's very strange to be like, 'that's not even a note.’” (Participant 111)

Others expressed their new singing voices:

- “Singing I feel great, cuz I can get down to like a, my voice dropped an octave post-T. Now I’ve gotten more up to like, a tenor 2 range. Which I’m not appreciative of. [Laughter]. I want my baritone range back. But that’s, you know, I haven’t been in chorus for three years. So, I’ll get it back. [Laughing]” (Participant 108)
- “My voice pre-testosterone entirely, it was very difficult. I had a very high voice. It was difficult to modulate down at all. Uh, it was difficult to belt when I was singing. Like it was – it was a very high like, it was like a high alto voice, just – it was not very deep at all. And, start of testosterone, it was a lot easier to modulate down. It still wasn’t organically just in a lower register. But I could modulate a lot more easily than I was able to previously and now it just sits here and that’s much more comfortable for me. I don’t have to think about it. I just sound like this. It’s great!” (Participant 104)

Some participants expressed mixed feelings with a sense of loss in their voice changes:

- “I don’t like my singing voice. Going back to your question of, like, how I relate to my voice – I used to really – it was, like, the one thing I like about my voice before T was just, like, I felt like I sang really prettily, like, I was – I don’t even know what I was, like, maybe an alto 1 or something. But like, I really liked how it sounded and then I just never, like, reestablished those feelings about my voice. Which is kind of weird cuz I, like, I mean, it’s not that I didn’t enjoy it, that I don’t enjoy that I sing lower. It’s just, like, I haven’t done it maybe as much and so I can’t appreciate what it sounds like. But I don’t know if it – I mean, I think maybe my voice seems less, um, crisp, I don’t know, like, when I’m singing.” (Participant 109)
- “I’m a singer too, sort of, and I could get into that whole aspect of things too. But like, the craziest – and, well, has been really crazy, like, sort of losing my whole range and

everything, and having a totally different range and like whatever – but like, the difference in just a speaking voice? Like that’s – that’s crazy. I used to be a, like, quite a good singer. Like, I was a choral singer for a long time and I was a high soprano. Like, I could hit all of the, like, Joni Mitchell notes. And I want to say in the past, like even just like 6 months, I think my voice has finally – like, my singing voice has finally like totally evened out into, most of the time, a place where it sounds pretty good. And I’ve lost, like, a huge chunk of my range, but like, I’m more comfortable.” (Participant 106)

- “I did not like my voice before T. Like I said I, I usually had the most high-pitched voice even out of all my cis women friends and uh, however I was a singer and I was a, like a soprano and I was very good so, uh, that sucks [laughing]. So, obviously that’s gone in the garbage. [laughs] And I’m still relearning how to sing, um, and um, I don’t know sometimes I’ve been really happy with how my voice sounds recorded.” (Participant 114)

Theme 12: Goals/Ideals. Several participants discussed their goals or ideals for their voices. Two brought up passing on the phone as their ultimate goal:

- “I want to, uh, have a higher percentage of passing on the phone. I don’t use the phone almost exclusively. Um, with just auditory processing difficulties and the fact that I use a speech generating device. I use TTY almost any time I can except for when it’s, like, gruesome. Um, and, so, like I want – oh god, I wanna be able to pass on the phone for when I have to use the phone. Cuz that’s one of the other things that makes it just, like, unbearable to have to use the phone is the number of ma’ams. Please hold, ma’am. No, you hold!” (Participant 111)

While another put more value into the versatility of their desired voice:

- “My ideal goal is to be able to sit here and read a book to kids and be able to swap [voice ranges] in a way that would like, both maybe scare and impress adults. So just, ‘wait, that’s a man voice! Wait, that’s a woman voice! How the hell are they doing that?’ Like, I, I want that level of fluidity. And even if I can’t achieve that then I wanna be able to at least have a really strong solid masculine voice. And sure, then maybe my woman voices won’t sound as, you know, perfectly womanly, but I will take that out of the two of them if I need to. So, for me being able to jump between those two is what I want more than anything else and having that ability to pick how I’m feeling because, even though I can go middle ground nobody knows what to do with middle ground. Nobody has any clue, they just go, ‘eh?’ and then it will be whatever personal preconceived notions they have about voices or other things that determine which binary they are going to put me into. So, being able to swap between the two of them – that is also kind of like, ‘oh you wanna put me in a category? congratulations. I fit, tick both of your boxes. Deal with that and have that be both a fun aspect for storytelling and different things like that,’ but also just in general. Like, if, I would love to be able to go from just going to a duet with myself like I do now versus, boom, more masc, then boom, more feminine voice, duet, head voice, chest voice – difference in seeing and feeling those differences because they do feel, in some ways like, completely different voices.” (Participant 112)

One identified their ideal singing voice as a tenor range and no lower, while another wished for a great singing voice in general. The participant who had not yet started T but was scheduled to start the day after their interview shared their hope that their voice would get lower, and the qualities that they would generally be happy with.

Theme 13: Consciousness of the voice and special cases. In response to broad questions about participants' relationships to their own voices, some participants referred to the changes that they notice in the way that they speak depending on context, separately from code switching.

- “I like my voice. I like that I sing baritone and that it’s lower. Um, I don’t love my voice because I hear, like, the trans voice in it and, like, the warbly – like I can identify with that and maybe partly it’s worry too because I don’t want that voice. And I also, like, I mean, right now I’m probably lowering my voice just because like I said we’re recording and I’m consciously talking. But I think in my everyday life, like, my voice tends to go more up here and I talk a little bit more in my upper range. Um, and that makes me more self-conscious, I think. It’s probably something that no one else notices but I notice it.”

(Participant 109)

- “In my own head I think it’s very very low and then I’ll hear myself on recordings and be like, ‘oh man.’ [sighs] ‘I have the trans voice.’ Or, I’ll be on the phone and someone will assume I’m a woman. I always get misgendered on the phone. And I think that’s part of how I speak on the phone. Cuz, I, you know, I learned to speak on the phone as a woman, so I learned to like, end my sentences on the up tone and ask questions and say please and thank you and rather than just like, [laughter] rather than just like, having a very monotone, not opening my mouth when I speak, like, like, you know? Not expressing interest. Being an asshole... Especially when I’m speaking to a woman on the phone, actually. And I’ve noticed that too, like, depending on who I’m speaking to face to face as well. My tone changes and the way I speak changes, so when I speak to women, I’m a lot more like, what did we say? The opposite of monotone. And, I don’t know if that’s habit of like, twenty-plus years of learning how to speak on the phone or if it’s – I know I

can be understood better when I up my tone a little bit, because tones are difficult to hear on people sometimes. So, I adjust my tone a bit higher.” (Participant 108)

Two participants, 109 and 107, had unique stories and comments about their voices which are further detailed in Appendix 2. Participant 109 came out as trans in the early 2000s, and has been on T for 15 years. He received his prescription from an endocrinologist without prior gender-affirming care experience, who prescribed Participant 109 a T dosage close to 3x as much as is commonly prescribed today. Participant 107 has no intention of going on T and only recently came out as trans. They have an extensive theatrical background accompanied by voice work, and have a unique perspective on voice work as a result.

Theme 14: Transness and Disability. A few participants talked about the ways in which their disabilities interact with their relationship to their gender. This is a topic not frequently addressed in academic research, and would be a helpful topic to continue to explore in future projects as this thesis barely scratches the surface. One participant uses a Speech Generating Device, and discussed their experience with finding a voice for the talker that felt like it accurately reflected their identity:

- “You have the ability to go in and change the speed, um, and the, like, you can change pitch some, um, I haven’t been able to do that without really feeling sounding fake. Like, you feel like you have faked a voice. Um, and realizing, like, the voice that I think that I want is probably between what is stated as a child’s voice and a adult voice. Um, I’ve tried to, like, mess with child’s voice to get, like, a change in pitch because, like, I am not a straight-up post-pubescent male voice, I’m aware of that. But I’m also not, like, 12. Um, so, like, it’s been interesting playing around with it and knowing that, like – that what I’m choosing, what I, what I pick influences what the person I’m talking to thinks.

And whether they think that that voice doesn't match cuz that's a choice that they can think of, or whether that makes them think about, like, what gender I might be. I've also noticed that, like, if we just didn't label them as male or female – like, I probably would have thought about some voices differently if we hadn't labeled them male or female. And then there's like that small piece that I am acknowledging because this is a voice study of, I don't want to bank my voice because I don't necessarily want my voice to be my voice.” (Participant 111)

Another participant discussed the ways in which the physical aspects of their disability contribute to how they are gendered:

- “Even if I don't say anything, some people can still go like, ‘Oh, yes! She!’ and I'm like, ‘I don't even have boobs anymore! How are you doing this?’ And then sometimes it's just like, ‘oh, you look queer and so we're feminizing you,’ or there's also that default of – and I don't have, uh, data for this cuz there isn't a ton of people that are in this area – but, it seems like the mere act of having a cane as a mobility aid makes people more likely to gender me as woman than not. Being disabled should not be inherently feminine, but it does definitely seem like that is a social connotation that I've noticed more that I've shed some more aspects that used to be more obviously woman or obviously this, or x, y, z.” (Participant 112)

Two separate participants explained some ways that their connective tissue disorder has affected their voice while on T:

- “I have, um, a connective tissue disorder that might be affecting how my, like, literally my larynx – because my larynx collapsed as like, a baby because my tissues were too soft and stuff – and so, um, it could be making my voice weaker. So like, my voice still, like

what do you call it? Cracks or pops or breaks a lot. Uh, more than I think other trans men on three years of T, which can make me sound like a teenager sometimes, and um, makes it hard for me to have a stronger voice. Um, and that's kind of difficult cuz that might be forever." (Participant 114)

- "I also have a undifferentiated tissue disorder. Basically, that means that all of my joints are too stretchy, so monitoring how my joints tensing up on testosterone – which is a good thing for me because of, right now, like, otherwise I have always been prone to like, oh your hip is like, degenerative, dislocate while you're driving, that sucks. Yeah, it, it, just ruins the morning. You're just like, 'great. Thank you. This was completely necessary.' You pull over, put it back in place and your, you move on, but it still is frustrating and it still drains you for the rest of the day. So, for me I have to watch and monitor both what I'm doing voice-wise and what I'm doing for my physical body because my physical body is just always angry." (Participant 112)

Theme 15: Access to information. One of the topics broached with every participant was how well they feel they understand their voice: how it is "supposed" to change on T, how it did change on T, and how to learn how to use a new voice. Three participants mulled over whether individual vocal training would be helpful:

- "[The voice is] a muscle and like, [a choir] coach, like, he's explained to me, like, the more you use it, right? The more it changes, right? So, if you use a lot of tenor, like, in singing. If you sing tenor 1 a lot, like, you're gonna lose your bass range, right? And vice versa. So, I think, you know, with speaking, I've never worked with a vocal coach and so I think I would like to, to learn how to speak and like, be perceived just through the voice." (Participant 108)

Some did their own research to figure out what to expect when going on T:

- “I definitely looked at trans specific resources, like TikTok, YouTube, Reddit, all of those kinds of things. Um, I also have, like, my old voice teacher back home. I kind of asked him since I was also, like, aging anyway with, like, the normal voice changes. It was, like, a little more stuff to be able to ask him, like, how should I make sure that everything’s still working nicely as my voice gets lower? Um, and that kinda helped too since he’s – he, for a lot of his students, sees them, like, through puberty and stuff, or at least, like, later puberty, so I knew he’d probably have some good tips for me.”

(Participant 113)

Others expressed that having more information about what will or has happened to their voice on T would help them:

- “[More information] would be really, like – especially singing, cuz it’s so hard. I found it really difficult to, to that break, you know? Like, I think it’s getting better, but when I first, you know, started [T] I was just like, ‘I can’t make that jump between the break and I don’t know how to do it.’ And I feel like, before transitioning I knew how to do it, it was just natural. I don’t know. Or maybe – I guess with, like, female voices maybe that’s not as much of a thing, but – so, it’d definitely be, like, nice to better understand that and like, have that training. I mean, I don’t know if I would do training for singing because I’m not, like, a serious singer, but, um, but also just, like, that attention on voice and what it means and, like, retraining your brain and, like, the way that you speak, I think especially early on would have helped me a lot in passing before I had means to, like, change my body physically. And even, like, before being on testosterone, like, having that training to be, like, to understand the differences in the way men and women speak,

you know? Would go a long ways too, to making that transition easier. And then preparing you for, like, after you're on T, like, being able to continue that. I think it would be super helpful.” (Participant 109)

- “I think honestly, like, more tips on keeping [my voice] healthy [would be helpful] cuz I feel like I overuse my voice. Um, it's hard to, like, feel like I'm protecting it while also in a range that I like hearing. Um, what else would be helpful? Honestly just for someone to tell me, like, how it sounds. Like, straight up, I wanna know what I sound like without, like, the bias of my roommates. They're gonna say I sound fine. And probably more specific guidance on singing and stuff, and maybe reaching some of those more tenor ranges that I theoretically could reach.” (Participant 113)

Others felt they were in an exploratory phase with their voices and other aspects of their presentation:

- “I feel like being able to explore all possibilities right now, cuz I think where I'm at, like, obviously doing anything, what I've been socialized to do and what I've practicing to do my whole life is gonna feel weird at first. Um, but I think, just like setting a baseline of like, 'hey! These are all the different possibilities.' I think even the study, um, was super, super helpful. Like, I didn't really know what I wanted until I like, got to hear voices and be like, 'I don't like that.' Um, so I think that is a baseline, and then like, kind of, yeah. I guess narrowing down from there. Or like, heck! Even being like, 'This is my customer service voice,' and I would hate talking – like this, and it isn't me at all, but I'm not going to get misgendered, and then I go and I talk to my friends and I'm like, 'ahh!' Like, I don't know. [Laughing].” (Participant 110)

- “I’d say that [my voice is] something that has possibly been on my mind in the more recent past, like, maybe the last year or so. As I’ve been actually spending more time observing, like, the ways of which I don’t pass for when I want to. And, like, having conversations with other people kind of in and around the space of, like, oh, well one of the things is that you take up no space. You make yourself small enough to fit the space instead of making the space big enough to fit you. And, so, like, I’ve had that in my mind of, like, how am I sitting in this chair? Like, right now I’m sitting here with my legs crossed, leaning against the desk. I’m very aware in this moment of, like – and this is not how I’m gonna sit to pass. And I, like, self-correct sometimes with that. And, so, like, I’ve had some more recent thoughts about maybe even just, like, word choice. I don’t have a lot of idea of how to manipulate my voice in any kind of different way. It’s something I’m interested in. I’ve collected cards of speech therapists that do gender things. Um, it’s just never been a high priority.” (Participant 111)

When asked to what extent they would be willing to work on their voice at this point in their transitions, 5 people thought it would be valuable to pursue voice coaching, speech training, voice acting coaching, or trans voice therapy – if they had the time and money to do so.

Theme 16: Trans joy. In a deficit-based field, it is important to emphasize the positivity and joy that folks get from using their voices. In that spirit, several participants shared things that they love about their voice and their gender:

- “I’ve been on T for like 3 or 4 years, um, and I – I feel like my relationship to my voice is totally inseparable from my relationship to like, T and my transitioning. I remember being like super – um, that was, like, one of the things I was like, most afraid of before I started T. It has ended up being the thing I love the most about transition. There’s

something about the, like – and I know I know that I talked a lot about the, about how like T voices don't have as much resonance, but like, when I speak it from my own chest, the resonance that I feel – that I like, never felt before – that, like, there's like literally nothing I love more. Like, that just, like – It's so sweet. Um, and just like, so, like, warm and echo-y and special. So I really love my voice!” (Participant 106)

- “Learning how to sing in a baritone range [was] fantastic. That made me feel like, super euphoric. And like, when I first started T, I noticed one day I could, like, hear my voice in my chest while talking. Or, feel it in my chest. It was like, ‘ah, it's amazing!’” (Participant 108)
- “Talking about euphoria is so important because until you fully experience euphoria, you can't distinguish between dysphoria and euphoria. And so much shame and guilt of like – there's so much guilt to even try to achieve euphoria. Like, people just shame you for even wanting that feeling.” (Participant 107)

The interview participants' relationships to their voices were all nuanced and complex. The conversations that took place after the quantitative experiment not only helped provide context to the data obtained, but explored histories and emotions that would have otherwise been completely left out of the research. They also provided a space for the participants to share their full selves as part of the research, and in turn were assured that the numbers they entered on the computer would not determine every outcome of the study in which they participated. The interviews provided a broad scope of transmasculine experiences which indicated both that every person's needs related to their voice are different, and that the current academic and clinical understanding of transmasculine voices is severely lacking.

Discussion and Conclusion

The corpus developed for the experiment encompasses a wide range of masculine identities. It includes folks from ages 23-67, a wide variety of gender identities under the masculine umbrella, and a racial distribution like that of the Twin Cities 7-county metro (Metropolitan Council, 2021). Since all participants grew up in or around the Twin Cities, the corpus is regionally and dialectically limited. It is by no means all-encompassing; however, its uses beyond this research project are limitless. In this experiment, it was used to gather data on listener perceptions based on acoustic information alone. Other experiments could expand on the corpus to include more identities and regions, including another set of talkers who identify as feminine and/or non-binary. More perceptual data could be gathered on any number of other qualities relating to gender identity, sexuality, or other areas entirely. It could even be used to aid research on the effects of testosterone on the voice, and/or provide educational examples to those learning about the perceptual differences between a voice that has been affected by HRT and a voice that has not. The existing data could be further analyzed as well: listener engagement, responses to the experiment, and correlations between acoustic measures and responses are just a few of the many areas for further exploration.

The corpus is limited in its encompassing of naturalistic speech. Due to the nature of the speech stimuli collection, the samples used are not exemplary of conversational speech – they are more similar to read speech. The focus on phonetic balance in the development of the corpus is a potential barrier to retrieving data that reflects perceptions of conversational speech, and further research could address this by developing stimuli from more naturalistic speech (which invites barriers of its own, including comparison between voices and linguistic accessibility).

In sum, the data collected from the on-line listeners show that the gender expansive folks had generally more positive reactions to voices compared to cisgender heterosexual men and

women. This is potentially due to the sociolinguistic implications of trans identities, as reflected in the qualitative interviews of in-person experiments: trans folks are hesitant to pass harsh judgment on others' voices because they have experienced voice changes themselves, and likely have spent more time thinking about how their voice presents to others. In addition, the on-line listeners were more likely to disagree with all statements compared to the in-person listeners. The quantitative data collected from the in-person transmasculine participants shows a vast array of reactions to voices and the desirability thereof, which shows that voice therapy cannot be a one-size-fits-all approach. The qualitative data from the in-person participants gave valuable insight on the thought process behind the experiment responses, real-life information about the participants' relationships to their own voices, and the lack of information regarding voice changes on T felt by transmasculine folks.

Sensitivity training, education on legislation, and diversity and inclusion initiatives among healthcare professionals are gaining traction as methods to help trans people receive more comprehensive care in a societal environment where we are often overlooked. These methods are undoubtedly helpful for cis providers to increase their knowledge in skills and promote discussion around removal of barriers. However, these initiatives do nothing to put power, information, autonomy, and agency directly into the hands of trans folks. SLPs must be knowledgeable allies for the trans community, but trans people must also have the option to gain knowledge on our own, without relying on medical providers for behavioral modifications. Trans folks may not have access to the latest medical journal, or the extra time to spend hours researching and dissecting something that uses inaccessible jargon. It is important that SLPs use what they learned from this paper in their practice, but more resources need to be allocated to

give information about trans voices to trans people directly, for free, and in accessible ways that don't take a master's level education to understand.

The voice is much more than a signifier of gender. It is a versatile tool with limitless possibilities. In an ideal world, no one would ever be misgendered, and every trans person would have the knowledge and skills to modify their voices into anything that they want. In the meantime, SLPs working with trans folks must understand that each person is looking for something unique, and help their clients get to that place. With this comes comprehensive knowledge of nuances – how to sound gay but not trans, the physiology of T voice, and the medical turmoil that trans folks have to endure to exist in the world – but space must be left for a client to be more than their gender and their trauma. Trans voices and trans people deserve to be celebrated as they are, and with limitless possibilities comes limitless capacity for euphoria.

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Appendix 1: Stimuli for Objectives 3 and 4.

The four tables in this section show how the recordings of the talkers (1-20, columns) for each of the sentences (1-27, rows) were assigned to the four conditions for the listening experiments in Objectives 3 and 4. In this table, X represents a stimulus that was presented in its original, unedited form; Y represents a stimulus with raised F; Z represents a stimulus with lowered formant; A represents a stimulus with a lowered F0; B represents a stimulus with raised formants. The participant IDs and sentence IDs match those in Tables 1 and 2, respectively.

Table A1. Stimulus Assignment for Condition A.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	X									Z									B	
2		A									X									Z
3			Y									A								
4				B									Y							
5					Z									B						
6						X									Z					
7							A									X				
8								Y									A			
9									B									Y		
10	Y									A									X	
11	Z									B									Y	
12		B									Y									A
13		X									Z									B
14			Z									B								

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
15			A									X								
16				X									Z							
17				Y									A							
18					A									X						
19					B									Y						
20						Y									A					
21						Z									B					
22							B									Y				
23							X									Z				
24								Z									B			
25								A									X			
26									X									Z		
27									Y									A		

Table A2. Stimulus Assignment for Condition B.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1									B									Y		
2	X									Z									B	
3		A									X									Z
4			Y									A								
5				B									Y							
6					Z									B						
7						X									Z					
8							A									X				

9								Y									A		
10									Y									A	
11	Y									A									X
12	Z									B									Y
13		B									Y								A
14		X									Z								B
15			Z									B							
16			A									X							
17				X									Z						
18				Y									A						
19					A									X					
20					B									Y					
21						Y									A				
22						Z									B				
23							B									Y			
24							X									Z			
25								Z									B		
26								A									X		
27									X									Z	

Table A3. Stimulus Assignment for Condition C.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1								Y									A			
2									B									Y		
3	X									Z									B	

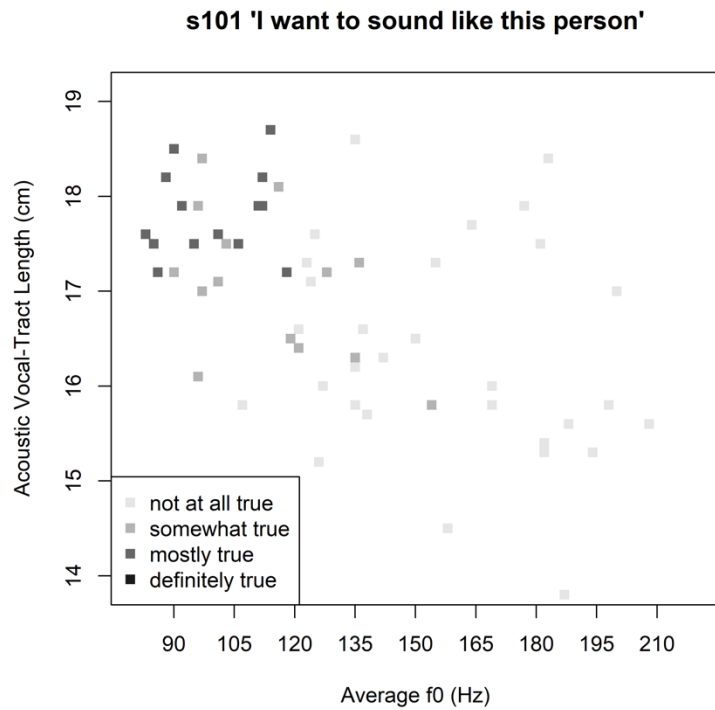
4		A								X									Z
5			Y								A								
6				B								Y							
7					Z									B					
8						X									Z				
9							A									X			
10								X									Z		
11									Y								A		
12	Y									A								X	
13	Z									B								Y	
14		B									Y								A
15		X									Z								B
16			Z									B							
17				A								X							
18					X								Z						
19						Y								A					
20							A								X				
21								B								Y			
22									Y								A		
23										Z							B		
24											B							Y	
25												X						Z	
26													Z						B
27																			X

Table A4. Stimulus Assignment for Condition D.

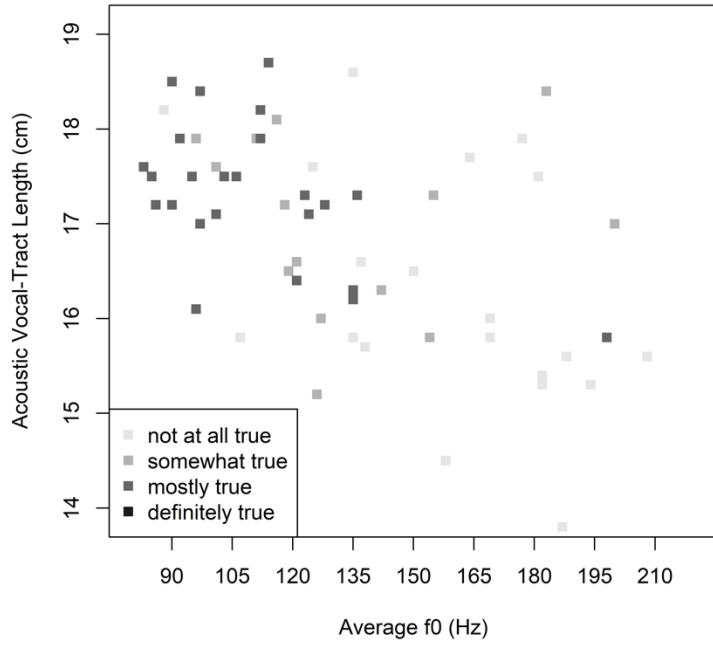
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1							A									X				
2								Y									A			
3									B									Y		
4	X									Z									B	
5		A									X									Z
6			Y									A								
7				B									Y							
8					Z									B						
9						X									Z					
10								A									X			
11									X									Z		
12									Y									A		
13	Y									A									X	
14	Z									B									Y	
15		B									Y									A
16		X									Z									B
17			Z									B								
18			A									X								
19				X									Z							
20				Y									A							
21					A									X						
22					B									Y						
23						Y									A					

24						Z									B				
25							B									Y			
26							X									Z			
27								Z									B		

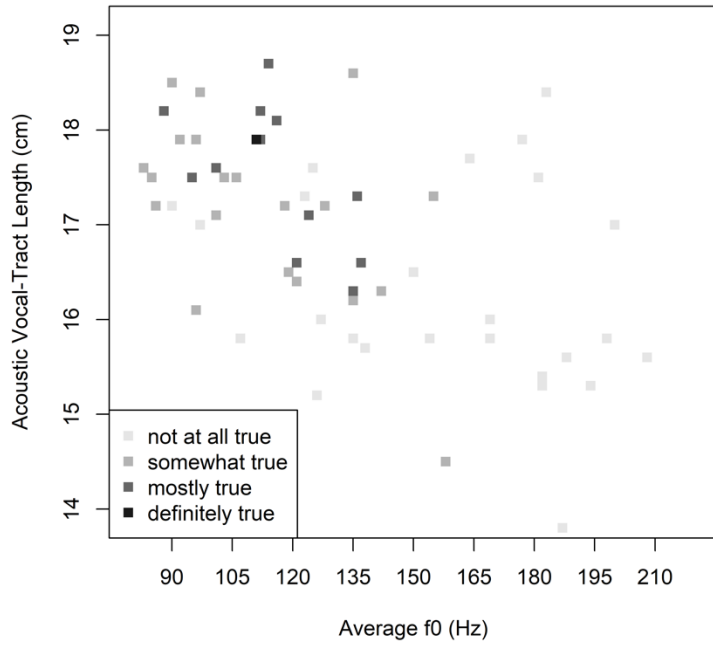
Appendix 2: 14 in-person participants' responses to *I want to sound like this person*



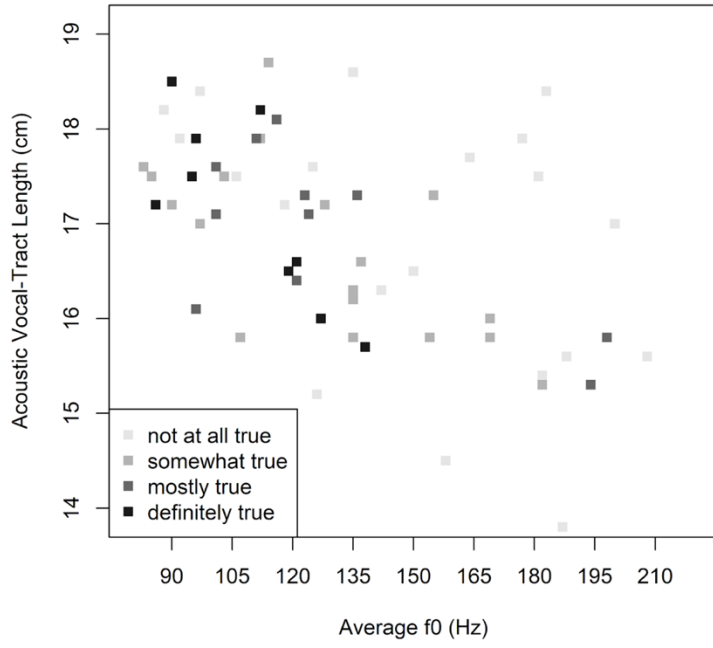
s102 'I want to sound like this person'



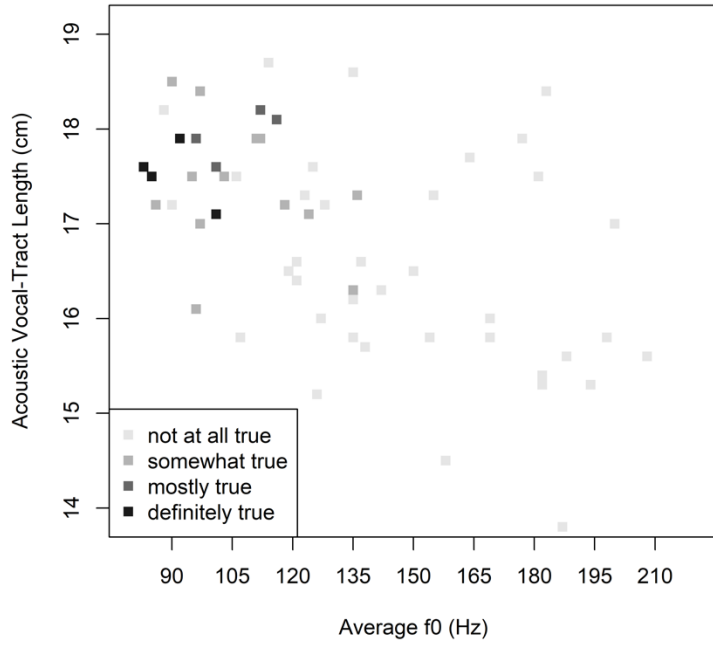
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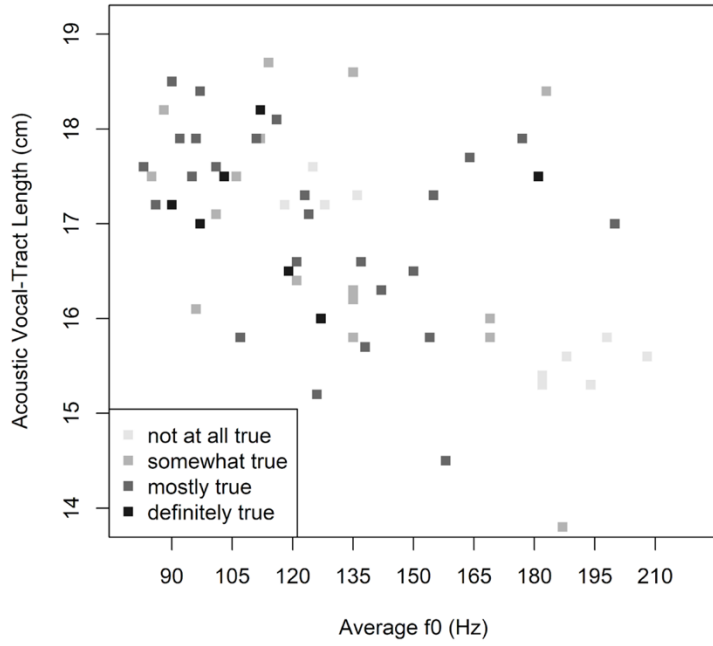
s104 'I want to sound like this person'



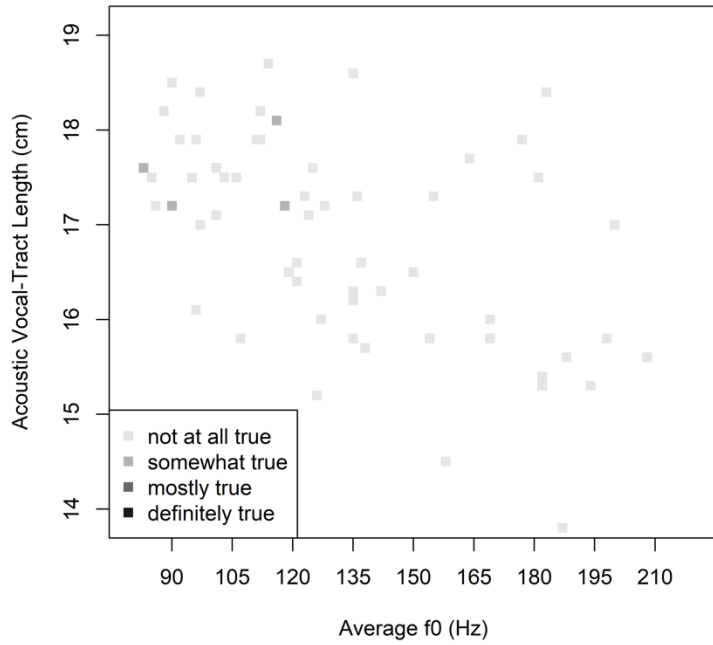
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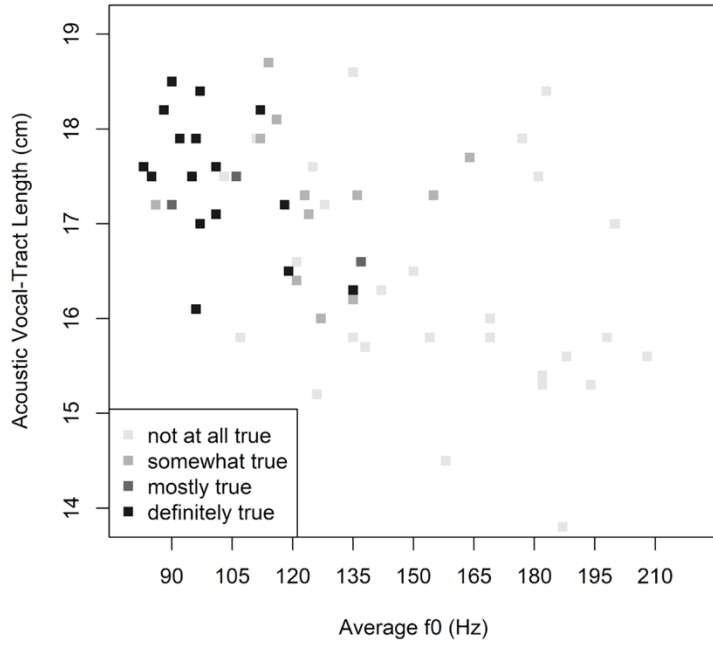
s106 'I want to sound like this person'



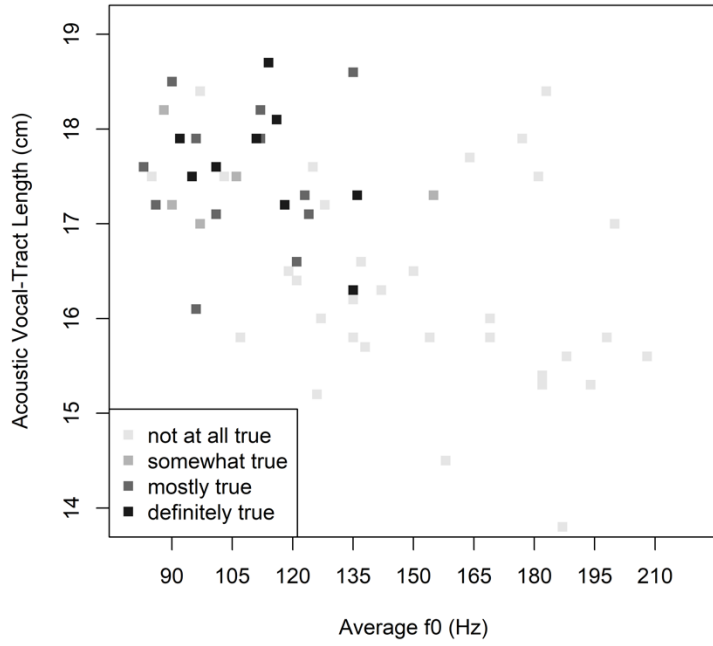
s107 'I want to sound like this person'



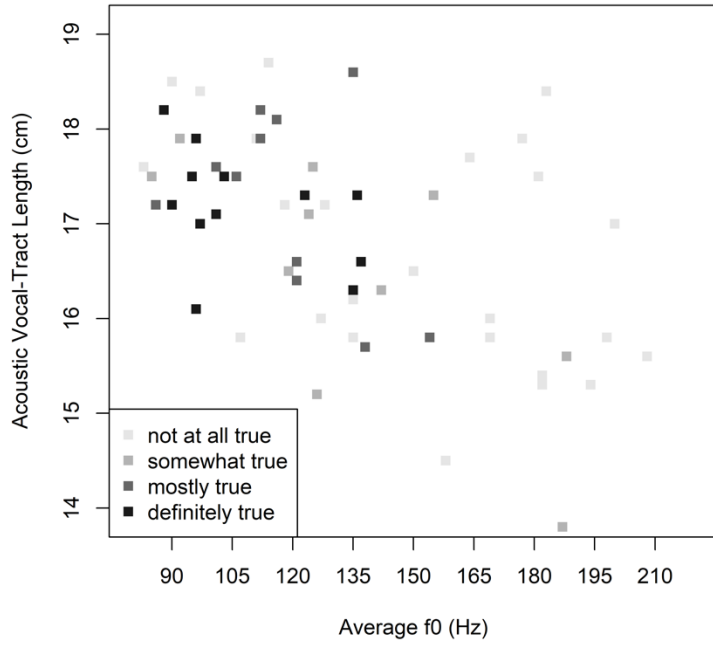
s108 'I want to sound like this person'



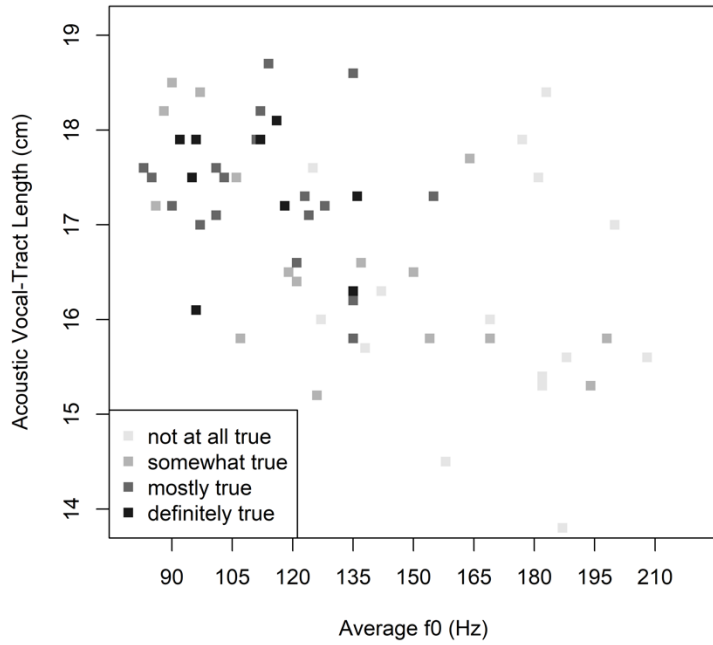
s109 'I want to sound like this person'



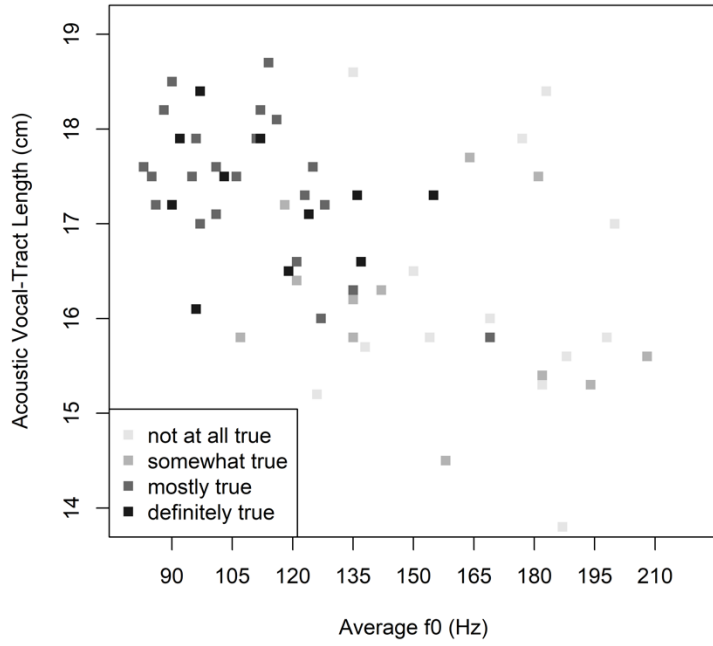
s110 'I want to sound like this person'



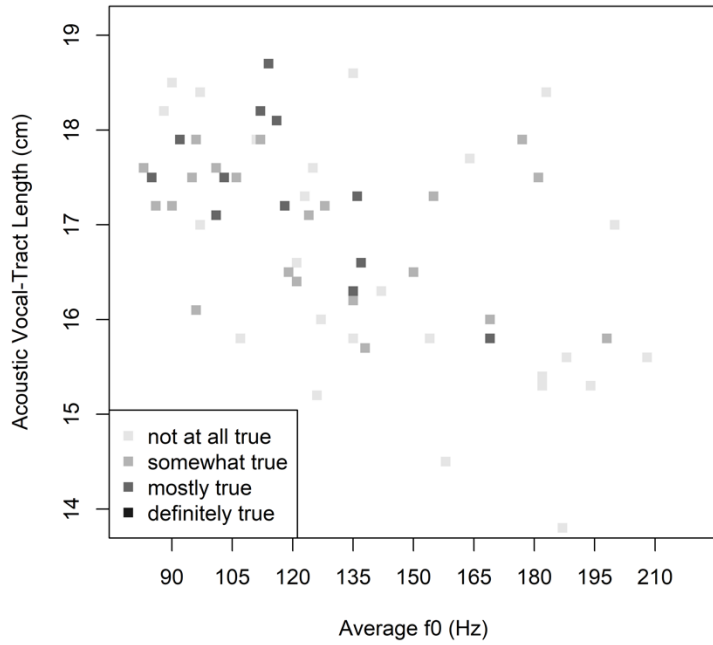
s111 'I want to sound like this person'



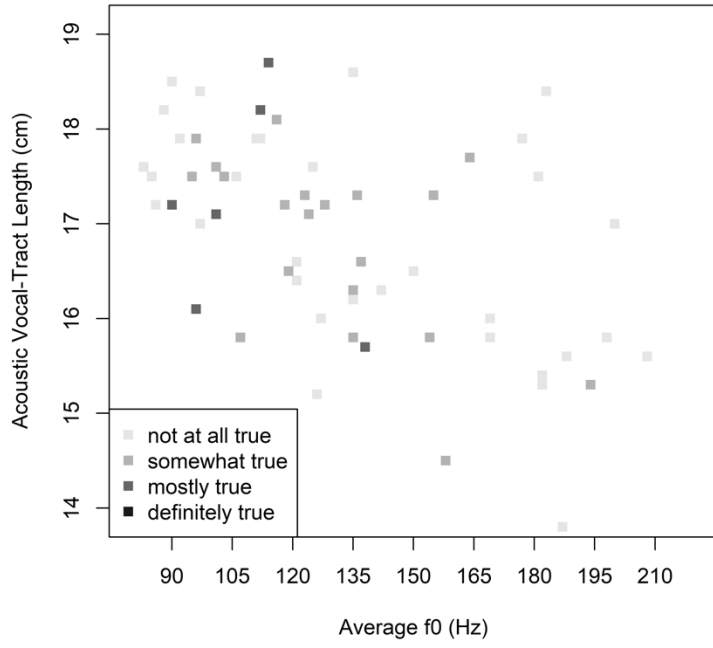
s112 'I want to sound like this person'



s113 'I want to sound like this person'



s114 'I want to sound like this person'



Appendix 3: Additional quotes from participant interviews by theme

Theme 1: In-depth descriptions of gender identity.

- “[At work] I specifically picked the more masculine form of my name, right? So, people would understand – and I’ve never been, like, questioned at work. I doubt people assume that I’m a cis man though. [Laughing] Or a straight man. They’re probably really confused when I say my spouse’s feminine name and they’re like, ‘you’re married to a woman?’” (Participant 108)
- “I had shame sometimes especially navigating queer things about my, uh, heterosexual appearing relationship and being read that way. Um, like, I remember the first time I went to a holiday party for my partner’s work. And one of his old department bosses who’s gay, who has a gay voice, um, uh, read me male. Um, who worked closely with my partner and, uh, had conversations with him about how, like, he’s the only employee that he’s seen in the store who doesn’t follow women as they walk away. Um, and, like, has specifically asked him, like, so are you gay? And had the no, I’m not. And then to have me show up and be identified as his partner and have... be read as male and have this like oh yeah. Like, his boss was flirting with me. Thinking, you know, finding me to be another gay man. Um, and how satisfying that was to not be my heterosexual partner’s heterosexual partner... There’s the I want to have the ability to assert my queer self especially in queer space and not... Like, my brother is stealth, um, I forget sometimes that he was ever anything other than my brother, um, and he navigates the world in very much cis privilege. Um, we have very different experience in this. Um, I want to have cis safety. I belong to, like, I’m in recovery and, uh, my home group read me male when I started going and it’s not a queer specific space. And I liked that for whatever reason they decided that I was one of the guys. Which, sidebar, guys are disgusting. I never knew I didn’t want to be one of the guys. Um, and I know that part of why I continue to be read male in the space is because I’m already established as male in the space. If somebody new comes into this meeting and they’re getting their context clues from others. But, so, like in that space, like, I want to pass. It’s the only place that almost exclusively I always put thought into masc. clothing. I almost always wear my binder. Which is not restrictive, like, I appreciate going into that space like that. But what if I didn’t want to?” (Participant 111)

Theme 2: Identifying qualities about a person based on their voice.

Authoritative vs. Insecure:

- “I think the lower the voice, the more authoritative I found them. For the most part. I think, like, things where it was harder to understand them, like, when it was crisp. When it was low and crisp. That, like, to me read as this person is authoritative but not insecure. And, like, when the voice was a little less – what’s the word I want? A little less, like,

maybe stable or, like, clear I guess – that’s when I was a little bit more, like, this seems like more of an insecure voice and not as authoritative.” (Participant 109)

- “If I thought they were more authoritarian, then I thought they were older, and if I thought they were more insecure, then they were younger.” (Participant 108)

Theme 3: Identifying gender based on voice alone.

- “I really, uh, was uncertain of the first question about just, uh, outright gendering people. Um, so, like, the second question was easier for me – um, like, are they cis or are they trans? Etc. And sometimes I just answered gender diverse when I’m like, eh, this person is probably not cis. Or at the very least they are a part of the queer community and maybe have a complicated relationship with gender...Um, [exhales], but, like, because it gave you an option to like, label another like, gender but I’m like I don’t know, labels are so specific though...I could say nonbinary, but, wha, but this person could be like me, like, where they have like, twenty different labels and can be like gender queer blah, blah, blah, blah, and so I, I really didn’t uh, choose that option very much. Um, I kind of forced myself to stick with trying to decide, you know, does person sound like more a man or a woman? Because that was like, opening Pandora’s Box.” (Participant 114)
- “So much of gender is visible presentation. If I hear somebody’s voice, I’m gonna, I guess glad that I don’t necessarily assume because it does mean that I’m able to affirm more people and be more open to other people how they wanna understand themselves. As I try to do that kinda, ‘Okay, how do you want me to see you?’ because I want work to be able to do that way. Even if that’s not where you’re at right now. I can add some of that to my brain that’s easy for my brain to do. That doesn’t take much work.” (Participant 112)

Theme 4: Identifying transness based on voice alone.

- “Going into it, I was like, ‘I can pick out the trans male voices anytime. They’re very specific.’ And then I, I don’t think I did. [Laughing]. There were probably a lot I missed.” (Participant 108)
- “I could usually tell cis men because they would have a lower register. Although, I could also be wrong about that – like, in my dream world I wanna believe that there are wonderful amazing transmasculine people who are able to go full baritone. Snap a finger and not have that aspect. But also just, I mean, this is also because of singing and vocal aspects – how are they working through their lower, upper register? And while that could also be a variable depending on how much vocal training they’ve done, if they’re classically trained or a variety of other things. So, I am a, I guess for a lack of a better way to put it, happy to be wrong about any of the guesses that I’ve made because that would mean that different things are more plausible than I would expect. But, some voices, it’s almost just like, it feels like somebody has been living in a lower baritone awhile and you can feel that kind of lived-in aspect to it. So, for that reason, I was more likely to mark those as a cis person, although they could definitely be a transmasculine person who did transition *a while* ago, so I always kind of have room for that.” (Participant 112)
- “[Transfeminine voice] kinda sound like a guy, but you still have a little bit of the higher voice, I guess I’ve noticed. Some of the transfeminine was hard for me. Because I feel like sometimes it can just sound like a gay man – trying to make your voice sound higher. Whether it’s because of, you know, estrogen like taking the steroid or whatever, or just purposely, because that’s just how you’re trying to portray yourself. Just the higher voice but still sounding like you have a natural more masculine voice.” (Participant 105)
- “I probably, focus more on like, how [transfeminine people] are speaking. Like, the tone might still be very low, but if, you know, they’ve been taught to speak – for a lack of a better phrase –

speaking like a woman. Um, and use like, a higher like, register, or, um, less monotone tones while talking. I could probably, like maybe pick that out? But I don't know." (Participant 108)

- "I didn't expect that but, like, there were a couple where I was like, I'm pretty sure this person is transfeminine because it sounded like they were trying to push their voice up." (Participant 109)
- "[Trans women are] trying to push for that head voice, where it might not be comfortable but it makes them feel mentally comfortable, so it's worth pushing through even if it doesn't sound perfect speaking quality." (Participant 112)
- "I was trying so hard not to be, like, clocking trans woman voices. Cuz that's something, like, I don't like doing as a person. That feels bad even though I'm trans. But I'm like, mm, that sounds like they're manipulating their voice a bit, um, and also, like, I love the way trans women sound in general. Just, like, low feminine voices are, like, my love, so." (Participant 113)
- "I *express!* Like, which, I mean there's a whole thing about like, like, there, and there are prob, and there, there are straight men who are like, very expressive, you know what I mean? But, it's just, I think there's this correlation between your unhealthy ideas about what masculinity is and how it's supposed to be, so I think it's why I had trouble identifying feminine voices or like transfeminine or like cis women voices because I'm like, I don't know." (Participant 110)
- "On the rarer times that I picked non-binary, it was always someone in my head who was born female. I think it's just my, my default of like non-binary equals born female, but not a trans man. I think there was just a couple of people where I couldn't tell at all based on their voice. So, I was like, well, I guess I'll be using neutral! [Laughing] I don't know." (Participant 108)

Theme 5: Qualities of the 'T-voice'.

Raspy:

- "To my ear, yeah, it does sound like a little bit of a rasp. Um, which, I don't know how else to describe it other than that. Like, maybe, it sounds like, I, I, I don't know. Like, it's a little more, the voice is a little more stretchy." (Participant 110)
- "I feel like there's usually a bit of a raspiness to it as well. Like, you can kinda tell they went through something. And maybe also, like, they don't know how to use it totally too, like, it's – since it's changed. Like, it kind of feels like they're more insecure about it a bit. Um, and also, like, yeah there might be more variation in it because it's not, like, so laser focused in the way they're using it, I guess. If that makes sense." (Participant 113)
- "There's a specific type of, like, raspiness that's pretty common. Um, what's it called? Vocal fry." (Participant 104)

Nasally:

- "There's just a specific tone. It's, you know. Most, uh, maybe not now, but I feel most of us who have transitioned, transitioned post-puberty, and so we don't have that larynx that grew, right? And so, we kinda get stuck in this, like, teenage puberty voice. Where like, it's thicker and lower – like, the vocal cords are thicker, but, like, we don't have the bass reverberation. But, besides I, it's hard to describe. It's just like this, like, slightly lower tone, but also with a very like, nasally, like, high back tone? I don't know how to describe it." (Participant 108)
- "I feel like there's, like, maybe a nasally quality. Also, like, maybe like, a youthful voice. So even if, like, someone maybe is older, their voice maybe, like, sounds younger." (Participant 107)
- "[I'm] listening to how they're modulating their voice and I think there's a sort of – there tends to be this sort of thing with transmasculine voices, like on T. Like, we like, we, I think often like modulate more. Like we try to get – like I'm doing it right now – like we try to get lower but we often end up going higher. Um, kind of, when we're not thinking about it. I'm literally (laughs) I'm literally doing it as I'm describing it. So, there's this sort of, like, it's, I think there's a tendency to go higher in a way that doesn't totally – I don't hear happening with cis men as

much. Um, and if I do, I tend to feel like they're gay. Like, there's a kind of – and then also there's – I think with trans masc voices there's a, um, there's a crackly-ness, um and a sort of, talking out of like, it's like, in between like a head voice and a chest voice. Um, that it's like, yeah – like, I feel like it often it, it's a little bit nasal maybe. Like, like it sort of sounds like you're talking out of, yeah, more like, like the voice is like deeper, but we're still talking kind of out of our faces instead of out of like our chests. Which feels a little, just, just in the like size of the vocal cord or

something, like but there's, yeah, there's something I think about the, um, that kind of like crackly nasal-ness, um, where there's like – you can tell that it's, like, deeper then like a cis woman voice would ever really get. But it's not always, like, as, like, resonant, um, and kind of echo-y as a cis man's voice gets.” (Participant 106)

- “Upon hearing the, like, nasally, like, trans masc T voice, I was like, ‘oh yeah, mhm. I know exactly what's going on with that.’” (Participant 113)

Buzzy:

- “For me, it's always like, the buzz in our like, vocal cords. So like, um, cis men just have like, had like more years on the, on T. And they, they have time to develop, like, this timbre, um, to their voice that I think, I think also a lot of trans men, we tend to, we tend to like, speak it in our head voice still and we don't speak from our chest. Um, so of us do some of us don't.” (Participant 114)

Tinny:

- “There's like a certain, like, tinny timbre to a lot of trans-masculine voices that I've heard before that I don't think I have.” (Participant 104)

Pebbly:

- “Some of [the voices] I was like, this really sounds trans. Cuz there's, like, that, I don't know, like, pebbly sound. I don't know how to describe it, but I think most people who are trans know what that sound is.” (Participant 109)

Gravelly:

- “There were a couple that sounded low enough that I was like, this could be someone on T. But there was something about the age of the voice that made it feel like it was an older cis woman. I wanted to say that there was some voice that sounded like someone was like, an older cis woman who just, like, really heavily smoked. It was a raspiness whereas, like, T voices more – less, less raspy and more, like, gravelly? There was a word I was using for it that was the right word that wasn't raspy. And I was like, that's the T voice word! Maybe like, hoarse is like, more T, and then like raspy just sounds like, a little more cis?” (Participant 106)
- “Gravelly to me feels like it has more of that vocal fry at the end of your range. Whereas raspy feels like you're – it's not too different, but it feels more like you're not hitting the vocal cords right.” (Participant 113)

Theme 6: Passing, 'clockability', and the voice as a gendering factor.

- “[Trans people] pick up on each other for a purpose. For a reason, honestly.” (Participant 114)
- “I think most people who are trans know what that sound [of T-voice] is.” (Participant 109)
- “Usually, I just feel like I know [they're trans], and they know [I'm trans] also.” (Participant 114)
- “I still feel like people do clock me, and I don't know, like – I'll bring it up to my spouse, and they will be like, ‘well I don't see how.’ Like, I'm like, ‘I think it's my voice.’ Cuz I do feel like I code switch, and it's typically, like, women that will like, clock me or like – there's, um, at our apartment complex, like all the receptionists, um, they'll like fumble with pronouns and stuff, but typically start off with like ma'am or whatever. And I'm just like, I don't know.” (Participant 103)

- "I just kinda wish that my voice would at least get just like, a little bit deeper um, because if I get a little bit excited, a little bit nervous, anything – it shoots right up and passing goes out the window. Um, but I'm also like, I, I know trans men that like, consciously all the time lower their voice or alter their voice and I just don't have enough like, space in the the brain box to be worried about that all the time, so I would just like it to be like subconsciously figure itself out. [Laughter] I don't want other trans men to not necessarily be able to clock me because I'm comfortable with that, but I just like, don't – like, people just thought I was an extremely young cis woman before T, like extraordinarily young, and now they just think I'm like my age. [Laughter] And, and also, I get lots of people telling me I sound exactly like my mom and I would like that to *not* be a thing. [Laughter]" (Participant 114)
- "I don't know where I'm at right now. I just wish – I wish that I passed, uh and I would just be happy with what my voice sounded like. Then, um, sometimes I wish I sounded like a cis man with a high voice instead of like, a trans man with an average voice. Which sucks, cuz I feel like that's internalized transphobia. [sighs] [Laughter] Um, I don't want the buzz in my voice anymore, I want to outgrow that. Um, because I think it sounds kind of, kind of, it sounds kinda like what, what cis boys have in high school. I wanna like, like grow past it, I don't know." (Participant 114)
- "In general, and my gender, I've been on this journey since starting T cuz I really thought, like, 'I'm gonna start T, I'm gonna pass!' and then it didn't happen so, now I've had to start like, devaluing passing. So, I started to ask myself 'why is it important that I don't have that deep of a voice?' maybe I can sing as high as I used to again, and maybe that would be cool. Like, maybe that would be an okay thing for me to do. Uh, or at least higher. Uh, and maybe that other stuff doesn't matter, but I don't know." (Participant 114)
- "When it comes to talking, I'm pretty comfortable with where I've landed. I know that at this point, um, especially on the phone, people still read me as female, which is frustrating." (Participant 104)
- "I can't necessarily pick between [masculine and feminine] because they both – it's, it's apples and oranges to my brain. In a way where it's like, I don't see either as bad or good or right, but if I have to pick one, I'd rather have the more masculine, oh, this man voice kind of thing for just your default boring phone calls. Because that always – that can just ruin the mood. Just like, 'okay, cool. I'm sounding super masculine, they're gonna gender me correctly.' It's like, 'okay, ma'am,' and I'm like, 'why are we like this today? I even picked a more masculine name, come on!' But, you know, you can't, you can't win everything and you can't do everything perfectly." (Participant 112)
- "I grew up with, like, a really high, quiet voice. I was singing from as soon as I could sing, um, onwards and I was, like, soprano 1 coloratura range. Horribly high, clear voice, like, I was always praised for, like no vibrato, like, it was just, like, pure, clear voice. Which is usually something you only have, like, when you're really young. And I kept it through, like, it's still like that now. Um, if I wanted to. Um, which like yeah, I liked it. It was cool to be able to use that, but I hated people thinking I was, like, younger. Thinking I was a girl, once I discovered gender. Um, and I always felt like I wasn't authoritative at all. Um, because I didn't, like, project. I just couldn't really get there and I also didn't know how to do that, like, comfortably in my range. Um, so, once I got to college I think is when I kind of explored pitching down my voice a little bit more in talking to people. Trying to get out of, like, customer service voice, which was really bad for me. Um, and then starting T, I was very carefully, like, monitoring my changes just because I didn't want to lose my singing voice as much as possible. Um, and I feel like the changes have been very slow but now I'm, like, getting towards the range that I wanna be in. And it's frustrating to me when other people gender me based on my voice especially over the phone. It's, like, the worst thing in the world. I don't know why because I don't care that much in person, but yeah. So, I'm very, like, caring towards my voice. I like it but it's definitely, like, ever changing and

that's kind of scary at the same time. But I'm finally, like, I think my talking voice naturally is finally, like, the right kind of range that I wanna be in." (Participant 113)

- "At my job I'm around 99% of women and so like, [laughs]. I'm five foot one [laughing] and wearing scrubs, like everyone looks the same. And even with my beard poking out of my mask, the other day a gynecologist walked up to me my about my patient and was like, 'yeah, I don't think the dad could, um, understand what I was talking about, cus you know men, like, they just don't get it.' I was like, [scoffs]!" (Participant 108)

Theme 7: Identifying gayness based on voice alone.

- "Because a lot of trans men are gay [laughter], or like, or like a little bit affective or whatever – not to, um but like so, so – so sometimes, so sometimes I was like hearing a T-voice and I was like 'oh, this is also, like, gay' um, but I think that when I sort of really, really clearly felt like it was a cis male voice that was also gay, um I was getting like, I was getting a resonance that I don't get with transmasculine voices, um and sort of like a slower deepness, but then also kind of um like a, like a feminine lilt, um that – and I want to say it, sort of like vocal fry, but not really? Um, like a more kind of– a lilt I guess. Yeah, yeah. And like, maybe like, a sort of raise at the end of the phrases. Um, yeah, I'm trying to remember the voices that I particularly felt like were cis and gay, um, and I think they tended to be, like, deeper but also kind of, like, soft spoken. And I think maybe like, spoke a little slower too." (Participant 106)
- "It's like, the femininity in speech pattern and maybe like, some turning up at the end, you know? Like, instead of, like, I think, an authoritative voice, like, ends their sentences down or like on the same note, but I think an insecure voice might, like, end it going up." (Participant 107)
- "I think mostly for the men I put cis. And, you know like, if they maybe didn't have the super deep voice or whatever like a stereotypical cis man would, you know, then maybe I kind of equated it to gay." (Participant 105)
- "I've noticed also that a lot of gay, cis men will go more into that head voice than the chest voice. So, looking for that differentiation was helpful, but then I would go, 'okay, but this could just be a cis, gay, man, who wants to have a higher voice.' But, not to the point where it sounds like, at least from my hearing assumptions because again, anybody could be at any path of their transition. No way to know. No way to do it right or wrong in that case, but looking at in that when I'm going, 'okay, this sounds like somebody who is being in chest voice even if it's not necessarily easy for them to be in chest voice?'" (Participant 112)
- "I think gay people say words a certain way sometimes. It's really difficult to describe; I'm not much of a linguist. it's treating sentences and treating the words that you're saying more like – it's like a performative way of phrasing things. Or like a, like you're singing the thing that you're saying, but you're saying it." (Participant 104)
- "I think there may be like, two voices that were like, um, maybe like, like, I don't even know, like, I think like, like – hyper musical? I think. Um, and then I noticed that I was like, 'huh, I wonder if they're gay', and then I would like associate like, a lisp with that, and then like, once I caught that I'm like, I don't like, I don't – I didn't associate with that further down the road. Um, so yeah. I think that, I think it mostly had to do with like, the effect of the voice and just like, how, how much up and down there was. I think it might've had to do a little bit with like, um, like, if something, like, I'll say probably what made me go, 'okay, more than a 2,' even though anyone can be gay at any point – because when I say gay, I also thought about like, gay versus queer and it's like, and I was like, 'okay, I'm reading gay, and like, the survey has acknowledged like, other gender identities, so I'm going to read gay as like, like man attracted to other man.' Um, and also like, any voice can be like that, but like, I would say if like, a voice is like – ah, I'm

trying to think – if like, the resonance was brighter and it was super musical, like then I was like, ‘okay, [that’s gay].’” (Participant 110)

Theme 8: Desirable qualities in voices.

- “It was always like deeper voices that you’d think would be for someone who’s, like, older.” (Participant 101)
- “[Pleasant voices were] smooth and deeper.” (Participant 105)
- “[I liked] a lot of the deeper voices, um the deeper and almost kinda like, smooth voices.” (Participant 102)
- “[I liked] lower registered ones. Ones that are either further along in their transition process than that I am now, to some extent, cuz I’m still relatively new.” (Participant 112)
- “Definitely more of the, like, lower pitched sounding people. Anyone that had a bit of the, like, gravelly quality. I really like that in a voice and would wanna emulate that. Um, and any voice I felt was, like, similar to mine. Like, I would have rated it at least a little bit similar to mine but usually a little bit lower. . . gravelly to me feels like it has more of that vocal fry at the end of your range. Whereas raspy feels like you’re – it’s not too different, but it feels more like you’re not hitting the vocal cords right.” (Participant 113)
- “There were a lot of like, very bass reverberation voices and I was like, ‘yeah, I want that.’ [Laughing]. I, I think it was very rare that I said I didn’t like a voice. I thought it was unpleasant. Um, I think for the voices that I liked they were very clear and I probably, I would imagine I picked the more authoritarian than insecure. Um, but then as far as like, ‘I like this voice and I want to sound like it,’ it was definitely more like, masculine-sounding, like, bass level or more monotone like, what we would consider typical men, how they should speak. So, I think I definitely could like – like, I wanna sound like them. They’re more typically masculine sounding.” (Participant 108)
- “I really liked voices that were like, emphatic, and like, had a musicality to them. Um, and also, I noticed I like, had a preference for voices that, like, sounded warm.” (Participant 110)
- “[I liked] the ones that were deeper that I assumed were cis men but that still sounded gay – the ones that were deeper that had, like, what I read as noticeably queer qualities were exciting to me.” (Participant 104)
- “So, there’s like – it’s kind of like the, if you just look, I guess what I would call, like, more of, like, the masculine end of voices, like, the lower end – there’s, like, the middle range, and I was really drawn to that. Like, not the super low ones and not the ones that were a little higher, but I would say almost all the ones where I was like, ‘yes! This is the voice I want.’ It was just, like, this middle range of this lower voice intonation. But not, like, super deep and garbly and not like – and those were the ones that I was, like, really drawn to. . . I also found that I had more strong opinions about lower voices. Like, when I got to the, like, when there were higher range voices, I was just kind of like I have no idea. Like, I felt more lost maybe because, like, I mean I hear my voice more and whatever. But, like, I felt like there was in my mind there was more of a range in the lower voices and I don’t know that that’s necessarily true but I found myself rating it more of a range.” (Participant 109)
- “I kinda realized when I was like, actually in the study when it asks you like, ‘do you want to sound like this person?’ It was like, a really confusing question for me because like, I’m like well, ahh, I don’t necessarily know if I want my voice to sound as deep as this person’s, but I want to sound cis passing, but that’s like a really confusing access and I think I’m kinda like, closer to feeling at peace about it than I was three years ago. Like, I can’t, like, maybe I can get like, vocal range back or continue talking at a more high-pitched way, but find a way to be okay about it and uh, I, I don’t know.” (Participant 114)

- “Oh my god, I like, way preferred women’s voices. Which is hilarious because I like, like, significantly more attracted to women and I was like, like everyone that I was like, [Claps] this person’s, I think they’re a woman. Uh, I was like I could listen to this person all day long. [Laughing]” (Participant 114)
- “I don’t know if I got their age correctly, but there was like some sentences that I felt like the person was like older – maybe like 50s, somewhere around there – um, and it was just like a nice warm tone, and it wasn’t threatening, or like too, like – I don’t know. It was like a nice mix of gentle and authoritative. It’s just a warm tone, like, I liked it. I felt like they were cis. But I could be – but also, like, they could be trans and just have like all of these years to, like, fall into their voice and like, practice and see, like, what fits them and what feels comfortable for them. And also, everyone’s voice reacts differently to testosterone so they could have just gotten the jackpot, basically. [laughter]” (Participant 103)

Theme 9: Undesirable qualities in voices.

- “Well there’s, like, this one voice that I was like, ‘this person sounds like they could be cis or trans,’ and they have like, a high clear speaking voice, right? But, um, and I was like, okay, like, this is like, like, I like this voice, I guess. Um, I, I wouldn’t, I was really conflicted about the um, ‘do I want to sound like other trans men’ because a lot of times I hate the quality in my voice that I can tell that I sound, like a trans dude, not like a cis dude. But I’m also like, hearing the cis dude voices like, wahh, I don’t really want to sound like this guy. I’m like, [Laughter] ‘Okay then, I put myself between a rock and a hard place because I’ve governed myself no good option.’ It’s kinda interesting.” (Participant 114)
- “I feel like there’s perception of like, ‘trans men just want deeper voices. Like, no matter what.’ And I feel like [this study] just totally broke apart, like, there are some voices like – well, first when I like, saw the thing like, ‘does thing voice sound fake?’ I’m like, ‘is that asking me, like, do I think people are putting on an accent?’ like, how does this voice sound fake? but then I’m like, ‘oh, that might have been digitally manipulated.’ [laughs]. Like, like, cuz they were just some that like, like, ‘oh, that sounds like, low only a computer can go,’ and that is where I’m like, ‘oh, yeah, no.’ I didn’t want that voice.” (Participant 110)
- “[I didn’t like] lisps. I heard a lot of lisps.” (Participant 105)
- “I was definitely having more negative reactions personally to more feminine-sounding voices, but that’s just from my standpoint, I, I don’t want to sound like that.” (Participant 102)
- “There were some times where I was like, ‘I really don’t like this person’s voice.’ When it had that deep, masculine quality. So that was interesting to be like oh yeah this, yeah – so it is more than just the deepness, I guess. Like yeah, the deep – the people that I’m thinking of have, like, a deep voice but are also care workers so there’s like, a, ‘oh I feel like I’m going to be taken care of by you.’ But then there was a lot of men where I’m like, ‘uh your voice is so – it’s the voice of the patriarchy.’... I want to, like, fight against it. Um, it’s like, a cockiness to the authority. So in that way it’s like, to me that feels like an insecurity. It’s like, both authoritative and insecure – where it’s like, ‘I am going to make you listen.’ Instead of like, ‘I’m going to be who I am and be present and, like, you’re gonna wanna listen to me because I’m in my full self.’” (Participant 107)
- “I would be willing to bet that some people would rate their, ‘I don’t like listening to this voice’ as a high number if it reminds them of their own voice or of their old voice. For me, because of how I understand myself and how femininity and masculinity is very fluid. I don’t really feel that way about other people’s voices. I just see it as their own. So, I don’t necessarily get dysphoria from anybody else’s voices, which I think is good, because it means that I can then be supportive of people wherever they are in their journey without having that negative aspect to it, even though I don’t think somebody having that emotional reaction is evil or bad. It just is. So, for me, the

only times that I ever rank anybody as ‘I don’t like listening to this,’ it was entirely based on, ‘this sounds like it’s been robotically changed in a way which could’ve been changing – or with some sort of recording issue.’ Where my brain was like, ‘eh, something here is wrong, eh.’ Otherwise, everything else was like, ‘that sure is a neat voice!’ Even if it’s not one that I relate to. And I think part of it, too, is the other piece is that I’d be like, ‘okay, like, this sounds like how I’ve been doing vocal training, so this is why I’m more likely to think this is a transmasculine voice.’ Kinda in that area.” (Participant 112)

Theme 10: Participants’ individual relationships to their own voices.

- “Oh my god, [my voice] was so huge [in my decision to go on T]. Well, at the time too I cared more about my parents’ opinions and my mom is, like, crazy with, like, control and stuff. She loves my voice. She loves that I’m musical and stuff like that. I could always sing higher than her and she’s, like, jealous and all that silly stuff. So, it was a huge factor. It took me – I would’ve probably gone on T, like, multiple years prior to when I did if I wasn’t worried about that. Um, I think I would’ve cried pretty hard if I felt like I couldn’t do what I wanted to with it anymore.” (Participant 113)
- “I did not particularly like [my voice] very much before I started taking testosterone. Um, I went to school for voice for the first two years of high school and switched out because I stopped loving it. Uh, and I think part of that was figuring out parts of my identity and not enjoying what I sounded like anymore. So, um, I stopped doing vocals in earnest for a while, and then I started taking testosterone when I was like 21 or something like that and my voice dropped a little bit in the first couple of years. I took it really irregularly, and I started enjoying it a lot more um, and then when I started taking it, uh, seriously and being consistent with it, earlier last year now, um, I – it actually sounds like my own voice to me at this point.” (Participant 104)
- “[Voice] was the highest factor aside from potential side bonus of things for [my tissue disorder] stuff. So that’s the primary motivator and then ideally, as much as, as sad as I will be to say goodbye to high soprano notes, totally worth that kind of potential exchange to be able to A) have a full, complete tenor range, and even then, if I’m lucky sneak a little bit into some, some baritone, that would be nice [Laughs].” (Participant 112)
- “I don’t like [my voice]. I mean, It’s the reason I’m starting testosterone.” (Participant 105)
- “I definitely just, like, cringed so hard in my talking voice [before T]. Talking voice was a big thing. Then I hoped that maybe one day I would have a singing voice that I’m happy with. Although, I’m sad sometimes about it. Just because, um, you know, I don’t know, it’s just something I had, I could always do. You know? It would take so much effort [to adjust].” (Participant 114)
- “Singing’s always been my passion and I want a professional [career]. But yeah, if I could find a way to afford singing lessons to help that transition – cuz that’s a big thing that’s kept me from starting testosterone is because I just started to get my voice to where I want it to be.” (Participant 105)
- “It seems like [T] can affect everybody so differently. You have no idea, doctors have no idea what it’s gonna do to you.” (Participant 105)
- “I still don’t really even know what I sound like. Like I can, I hear it obviously everyday but there’s also times where like if I’m thinking I feel like my voice in my head still sounds like my voice pre T.” (Participant 103)
- “I have no idea what I sound like.” (Participant 110)
- “I think like, now that you know I think [my voice is] very much settled on T. I don’t think that it’s going to go change physically.” (Participant 108)

- “[It was] probably like, a year or two [after starting T that I felt like my voice had settled].” (Participant 108)
- “I think things are still shifting. I feel like in the last couple months I’ve noticed a decent drop, so I’m preparing myself for it to go lower and I think it’ll be a good change. But for the most part I think things are pretty solid.” (Participant 113)
- “I would say, I’ve, it’s taken me a while to get more comfortable with my voice. Um, I would say, um, before I, even before I started going on, like, hormone therapy I like, I never particularly disliked my voice. Um, I would say the point where I probably felt like the most uncomfortable was like, early on with T. Where I was, like, not stable at all.” (Participant 110)
- “I’m sure you can hear I’m, like, doing some of the vocal fry, um, I don’t like when it cracks, um, I don’t think anyone does. I’m like oh yeah, I am kinda going through puberty. I think projecting is a lot better now. I can definitely, like, talk louder than I used to. But I sometimes don’t realize I’m doing that, and it sounds like I’m not quite yelling but I’m getting a little, like, up in arms – I don’t know – when I’m not, like, meaning to. And I’m definitely kind of monotone now and I realize that. And that wasn’t, I was much more of, like, a sing songy voice as a kid. Maybe some of that’s because I’m more, like, sarcastic, and, like, over it, um, but sometimes that can get taken the wrong way too, so. Yeah, I struggle with sounding, like, enthusiastic without immediately jumping up in pitch.” (Participant 113)

Theme 11: Singing.

- “I have been on [T] for, like, a year and a half. Um, I don’t think it’s changed my voice a ton but I’m, like, a classically trained singer so I also know how to, like, manipulate it pretty well. Um, and I used to have, like, the highest, quietest, tiniest little voice as a kid. Um, so I’m constantly – not constantly thinking about it, but a lot of the times I’m thinking about it and changing it to how, like, I want it to be perceived and how I wanna sound.” (Participant 113)
- “[T has been] Good, just objectively good. It’s weird because I was expecting more voice cracking and that hasn’t really happened, but then again, I am on a low dose of testosterone for the kind of the non-binary aspect, and I also need to monitor it and keep track of it because I also have a undifferentiated tissue disorder ... adjusting to the differences been definitely different, but even just tracking and being able to watch as I hit a couple more notes that are lower, that’s always an aspect that just makes me feel objectively better. Cuz, then also, that those notes are gonna sound closer to how I want them to sound and not, ‘well, hey, I could hit that note, kind of.’ What I was using that was like, yeah you can technically hit that note but it doesn’t sound good. It’s not, you can’t have a real good space you need for it. It doesn’t ring or resonate the way that it should for a chest voice, or different things like that. So, being able to have, hit those lower notes and be able to actually have them sound like, how they should sound in terms of like in terms of classically trained stuff even though it’s not at that level but still learning how to make them sound the way I want, is, that has been great because it’s like, ‘okay, this is actually a thing that I can do.’ And then, of course, you have your usual thing that I think happens for anyone that’s just, ‘okay, how big can, how can I make this faster? Wait no, I should be smart about this. I need to watch this and know what I’m doing. I’m taking this slow for a reason, begrudgingly, but also like, it is important to be aware of how my body is reacting and how my brain is reacting and also keep it balanced and then go back and, you know. Alright, cool, that’s awesome, now we’re going to go sing an aria, because we need to see how much we can hold onto for the outer range and swapping both of those back and forth a little bit.’ But it has been any time I had to sing in soprano, not really, dysphoric in the way that it has been for a long time because I can switch, cuz I don’t – it doesn’t feel that I’m trapped in that spot. I have the choice to switch and I

have the choice to go lower. I still definitely don't sound as masculine as I want to, but at least it's getting there." (Participant 112)

- "I think just there's more range [now than pre-T]. Um, I think I'm also just more aware of the different places that I can take my voice. Um, I will say, like, there's like a, maybe it's more of my singing voices. There's more like a firm thing in the middle, where it's like, nope. Does – doesn't exist. But, like, I feel like the extremes of my voice maybe have more potential whereas like, maybe before T, I feel like, more – I was like very mezzo, like very middle, kind of voice. Um, and, yeah. So, maybe, like, kind of more limited at the extremes and like, kind of like the inverse happened on T." (Participant 110)
- "I feel like as far as, like, singing goes, I feel like my voice kind sounds like, breathier now. Cuz like, it sounds stressed here so I would sort of like it to be like, like, more clear and resonant and uh, you know? Um, not necessarily deeper, um, but, yeah." (Participant 110)
- "I pretty much have my whole range still, but I don't really like singing a lot of the soprano parts anymore just because they feel not as, like, comfortable, and also not as good for my gender. Um, but I'm not quite in a, like, comfy tenor range either, so. Mostly just enjoying a, like, nice alto area. Which I always wanted as a kid. So, I'm happy to have it now." (Participant 113)
- "After my voice had stabilized for a while, like, one thing that I think is really funny, is that like, I can hit notes like, effort singing-wise that I used to be able to hit before if I like, really like, [push]. But I don't know if that's actually stretching the vocal cords because they're, like, thicker now. Or like, what the science behind it is. Like, if I, like, make my voice sound really silly, I can sometimes hit higher notes. Like, that, that's fun! I mean, it doesn't sound good, but – or like, it doesn't sound, like, performance-worthy. But, I, I can hit the notes." (Participant 110)

Theme 12: Goals/Ideals.

- "My ideal, at least speaking voice range is just, just kinda, just enough for when I'm talking to a cis person on the phone, they'll call me sir and not, ma'am. That's honestly all I'm aiming for in terms of that area and then beyond that area, it's kind of whatever happens happens. But I also don't wanna lose all of – at least my – so, I wanna be able to maintain some of my soprano 2 voice is kinda where I'm at for goals at this point. And then, however much I can get out of lower register. I will take whatever I can have. [Laughter]." (Participant 112)
- "The harder thing for me is that, in my ideal thing for like a vocal range, if I could keep everything I wanted to, I'd keep my incredibly high soprano goal way down to baritone. I don't think that's physically possible. Granted, I've always been someone who's been able to sing very high soprano and go into tenor even pre-T. That's always been such a wide vocal range. The hardest thing for me right now is going, 'I'm sorry soprano, I'm probably not going to be able to sing you forever.' I'm, I'm going to lose some of that soprano 1. Although that's sad – I love that idea of getting more of that – but at the same time if I could switch, you know, snap my finger and be able to have the complete and total range, I would want that." (Participant 112)
- "My ideal is being able to potentially sing something like, in a soprano and then go down two or three octaves and be lower. The range has always – and that's been the case even since I was little. That's always been something that's been important to me. Like, for the longest time singing alto 2 was like, the best thing. Then I was like, oh, that's just cuz, that's just cuz transmasc. Got it! But I also enjoy that aspect of being able to do harmonies or different things so for me it's almost like, I like to match where somebody else is at and then figure out what would fit in with that and if that's upper or lower it kinda, just a coin flip wherever that goes. Which is complicated!" (Participant 112)

- “I don’t think I wanna be a bass. I don’t think that’s the voice I want. I’m pretty happy with tenor range. Um, I would like to feel more confident getting to the bottom of the tenor range.” (Participant 111)
- “I would say for me, things that are important to me is like, um, I, I would love a great singing voice. I would love that.” (Participant 110)
- “[I hope my voice will] deepen [on T]. I like to sing so that’s going to be something that I’m hoping will be a smoothish transition. But I realize I’m probably going to go through a second puberty. But, yeah, just hope to have a voice that I can actually, like, talk in and, like, be happy with.” (Participant 105)

Theme 13: Consciousness of the voice and special cases.

Participant 109:

- “Growing up as a girl, you’re taught to speak a certain way that is completely different from how boys learn to speak. And I feel like I still have some of those, like, rhythms and intonations, which in some ways doesn’t bother me cuz I think it just makes me sound more gay, you know, cuz it’s more feminine. Um, and so I’m not, like, super bothered by that, but, um, but I feel like sometimes I get too high especially if I’m, like, really excited. Like, I really start to, like, be, like, way up and it just, like, ugh. And maybe it’s partly, like, flashbacks too. I get a little, like, flashback. Um, but then also just, like, that gravelly voice I just don’t find it, like, super attractive in my own voice and I wish that I knew, like how to – sometimes I feel like I’m fighting my vocal cords if that makes sense. Like, physically. Like, that they try to be what they, like, knew or something and just, you know what I mean?”
- “I think if I’m really relaxed with a person then I think it probably comes through more cuz I’m just sort of, like, loosey goosey or whatever. And I guess it doesn’t bother me that much really cuz I’m gay it’s fine. Who cares? It’s also like in a way I feel like that just masks the trans aspect of it. You know? And it kind of bothers me that I feel like I need to mask that. But that is a whole other story.”
- “I perceive my voice as being not as trans-voice as some that I’ve heard. Like, especially people who are maybe like, on a lower dose of T. Like, my dose of T when I started was crazy cuz that was before there were standards and, like, anyone knew anything or had even thought what are the implications. So, they were like, ‘you wanna do, like, 100 or 200 milligrams at your first shot? Sure!’ I mean, I just went to a regular endocrinologist, he’s like, ‘this is what we’d prescribe for a man your age so let’s do this.’ So, and I don’t know how that impacts but, like, you know, like, I think people who are on a lower dose probably have a little bit more of that higher range, like, trans voice.”
- “In some ways I think it’s easier being a gay trans man than it would be to be a straight trans man. Cuz I guess I had never thought about it really but, like, someone who is straight probably gets clocked as being gay more often I would think. Maybe possibly. I don’t know. Maybe not. But in my mind it’s like, oh, it’s just convenient, I guess. [laughter]”
- “It’s insane but, like, I used to go, like, up and down, up, and I do feel like my voice would be higher towards the end of my [T] cycle, like, just a little. I feel like towards the end of my cycle I would talk more in my upper register, up here. And, like, when I was, like, just did my shot that it would be lower. So, I do feel like that – I mean, it’s definitely for the most part settled. I mean, it’s probably very little variation.”
- “I would just say, like, speaking more with, like, male intonation and then also the kind of gravelly tranny voice. Oh, tranny I don’t like that. I haven’t said that in a long time. Sorry, that

was going back to my, like, early 2000s when everything was, like, you're transsexual. That was the word."

- "Sometimes I feel like I'm just, like, fighting it. Maybe it's partly my – because I try to talk lower when I'm feeling insecure about it and maybe that's just, like, not really where my voice wants to be. I don't know – Like, if I'm on, like, a really long meeting at work I can definitely feel it afterwards. Like, uhh, I was definitely probably pushing hard."

Participant 107:

- In acting school, I did four years of voice and speech so like every day working on, um, my voice – of like, speech exercises and releasing the sound into my body. So I do feel like the voice I have right now is coming from, like, a very centered location, um, I do think that when I'm not centered my voice gets higher pitched, um, and can, like, show that I'm feeling anxious or insecure. Um, but I think when I'm at my most grounded my voice is, like, yes reflecting the groundedness. And so I worked, like, yeah just releasing sound, working on vowels, releasing sound to, like, all parts of my body. Um, working to, like, enunciate words, taking time, like, all of those things spent like – and breathing. Worked on breath and breathing to make sure my breath could sustain my voice."
- "I think now that I've, like, really come out as trans and also, like, butch I, like, don't feel this pressure to have a higher pitch when I'm meeting new people. Like, I'm not feeling pressure to be friendly or nice to people. And when I am being friendly and nice, that's when I get, like, really sweet and, like, very feminine, um, and I just, like, am saying 'fuck it' to that. And, like, fuck it to being liked by everyone. And so that's showing up in like – cuz I'm now just – I mean, I just get looks all the time for looking, like, the way that I do. Especially when I go up to [northern Minnesota]. Um, like I got some really weird – I was there this weekend. I got some fucking weird looks from this old miner in the bar and I literally stared him down. Like what is your – like what are you?"
- "The voice is so interesting and I guess I'm, yeah, I am a little bit more conscious or, like, feel weird when I do sound feminine. And, like, maybe like, do sound like a valley girl or a bimbo cuz I can sound like that cuz I can get in a really goofy place and whatever. But that's part of my voice and my expression so I'm just like, I don't know. But I do, like, feel really sexy when my voice is lower."
- "If my voice was to be, like, lower most of the time that would be kind of hot. I would feel, like, definitely affirmed. Like, that's when I think when I'm coming out is like, 'well what makes me feel confident and sexy? And, like, what is attractive to me?' And it's like, ooh, if my voice was lower, like, all the time like ooh yeah that would be fucking hot! I'd like, give myself shivers. [laughter] But that's been my whole journey of, like, gender is, like, figuring out what makes me feel like 'oh my god, you're so fine.' Cuz I've never felt this way until I came out as trans. Like I've never felt sexy until recently, until this summer and now I'm like oh my god! It's been amazing. It's been amazing. And, like, I have a new love for my body too. I'm like, 'oh, I've got a trans body! I'm like, not a woman. I'm not a man. I'm, like, this other fairy thing.' And it's exciting!"

Theme 14: Transness and Disability.

- "Passing was a big concern for me because I struggled to pass um, for many reasons. One of them being just, gender nonconforming and the other one was being like, perceived as small. Another

one is being disabled, so uh, that's actually been a bigger one. I, that's actually been like a bigger factor since I started transitioning than I've ever imagined." (Participant 114)

Theme 15: Access to information.

- "I'm trying to think of if I would like, do vocal training to like, sound more masculine or not. Which is something I thought about before, and I don't, I don't think that I would. Um, but I do really understand [why other people do] it. I do find myself like, um, like trying to modulate my voice when I want to sound a particular way, so I don't know if I necessarily wish that I had more control over it or more knowledge um, for myself. But I do think that I like, it would be really great if more information was available, because I know like I definitely know people who, um, who like, it's really hard when their voice cracks in a silly way or when they like notice themselves like talking in a way higher register because they, like, can't control it. I'm like, watching my little brother who is 17 and just start – has been on T for – I was going to say six months, but I feel like it's been a year and I just don't understand how that – [laughter] but he's like, a kid. We talked about that a bit and like, watching like, his voice change in like, a sort of more like, slightly more normal time for your voice to change, and sort of like, what he's feeling about that. And I do know like he, um, like, would love to – like love to, to like – learn how to modulate his voice lower. And that is true for a lot of people I talk to. I wouldn't say that I need more knowledge about it, but it would, like, having that available would be fun because I think it's not readily available. Or like, the only place it is are on, like, deep cut trans reddit sub. You know, like, people don't talk about it." (Participant 106)
- "[I] do [transmasculine voice training] virtually online, at least, and stuff like that. [My trainer is] Classically trained, knows all the nonsense and also who is autistic so knows how to talk to my nonsense in my brain of overthinking legitimately everything. And helping me do that a little bit less or, you know the typical thing that is apparently common for a lot of transmasculine people is just pushing lower even when your voice is like, 'I need a break.' So, helping me not do that and actually give my voice breaks when it's necessary is – it's definitely better and helps me feel more comfortable. And it's interesting is like, there is definitely a chance that once I get comfortable to the point of being able to pass, say as a sir on the phone, I will probably still then be fluctuating between how I talk or sound on a daily life spectrum level." (Participant 111)
- "I had the ability to research [the effects of T] how I wanted and like, ask the questions that I wanted cuz I already had that interest and like, knew where to kinda look for those answers." (Participant 108)
- "I tried to sing as much as I could, like, just on my own. Also doing, like, vocal warm ups and stuff to keep that range, like, warm, I guess. Um, doing a lot of, like, just the basic things you do as a vocalist to warm up. I don't wanna do them now, but just anything where I'm, like, doing, like, the big sighs and stuff from, like, the top of the range. Doing stuff like that. Um, I did, like, do a little bit of, like, research into vocal training specifically too when I was trying to kind of see how everything worked. But honestly just using it was enough, I think." Participant 113
- "I've been trying to find a – really hard to find like, cis male singers that match more closely what I already have. To make myself feel less like shit. Like, I had goals, like I wanted to sound like – God, I can't think – um, there was just like, a lot of songs that I thought I'd be able to sing once I was on T and I was like, 'yeah, I'll sound like this guy!' No. But now I think gravitating towards, like, uh, singers like Billy Corgan from like, Smashing Pumpkins who's like, famously super high voiced, right? Um, and it's genuinely been alleviating a lot of the dysphoria that I've had. I've realized that like, I can sing in a high-pitched voice as long as I'm not like, subjecting myself to like, this like, really rigid idea of what I should be sounding like. And also that there's like,

cis and trans people who've already, like, done amazing work that I enjoy and I just like, need to get over these internalized things about it." (Participant 114)

- "I like to know things so, like, knowing what's actually physically happening [to my voice] would help me to then understand, like, how it's all working, I guess. You know? And that might just make me feel more comfortable, but also more confident, you know? That, like, things work to like – you know, it's strange to say but sometimes I'm like, 'is my voice really that much lower?' Which is silly, cuz, of course it is." (Participant 109)
- "I would say that, as a singer – and I know that this is true for like a lot of other people that I'm friends with on T – that, um, more information that I would have loved is like how to do – have kept some of my range or not lost so much of it. Or just how to – cuz like, I do know that there are people who like, go through training for like their whole early time on T and can retain some of their singing voice. And that sort of like, that's information I would have loved to have access to. Most of the people I know have, like, lost almost all of their range." (Participant 106)
- "I've just seen, like, different types of transitioning have, like, widely varying outcomes for different people. So, I've just kind of accepted before I was going to go T, like, 'hey, this may like, be vaguely more in the direction you want to go in, but you could land anywhere.' Nothing that has happened has particularly, um, like, surprised me, and like, nothing has happened with my voice where I was like, 'oh, I didn't think that was going to happen!'" (Participant 110)
- "Voice coaching every, like, biweekly – maybe that'd be doable. Or like, not even voice coaching like how we were talking about earlier, like voice coaching with like a speech language pathologist, but like, just with like trans elders. Or like, technically I'm a trans elder now which is like, strange, cuz I'm not that old but I've surpassed that age limit." (Participant 103)
- "I thought about, especially when I first started testosterone and when I was on a lower dose and not taking it as consistently, I thought about just finding, like, a speech trainer. And I've thought about finding a vocal trainer ever since leaving school for voice when I was much younger. I just haven't had the funds or the time or any of the other resources to make that happen. I would love to work with, like, a vocal coach either for singing or for speaking. I think that that would be a really interesting and valuable experience. It's probably something I will pursue at some point in my life, when I have more of that time I was talking about." (Participant 104)
- "I literally like, wish I had money to like, go to, like, a voice acting coach and like, just make stupid noises all day." (Participant 110)
- "I really wish I could afford like, uh, voice therapy. Uh, specifically to work on my singing. Uh, because that would really improve my mental health and how I feel about my voice in general because I really had a passion for – for music, and it really makes me sad a lot that um, it's taken so long for my voice to get strong enough to even like, hold a note." (Participant 114)
- "I've had pretty good experiences thus far in gender related therapy, so – I have gender therapists a couple years back and then also, um, my current therapist isn't a gender therapist but is trans and that's, like, monumentally helpful to me. And I feel like, if I was to see like, a really trans positive, like, voice coach basically, I think I might be able to overcome some – I, I definitely have like, uh, ideas about my own voice that I don't have about other peoples. Um, and I think just like, having somebody who's like, knows what they're doing, can tell me a little about, like 'no, it's kinda in your head dude,' like, [Laughter] and also maybe be able to help me like understand like, why I don't pass uh, in certain ways that aren't like harmful or, aren't like 'I'm here to teach you how to be cis,' or anything, like, I, I don't know. I don't know what voice therapy is like. I don't know if that's what they do in voice therapy if they're trans positive." (Participant 111)

Theme 16: Trans joy.

- “I sing all the time. And that’s also the thing, like, I love being able to sing high and I also love being able to sing low.” (Participant 107)
- “I love my voice and I feel like [I can make] a bunch of different weird sounds now. Uh, and as someone who's like – I don’t know if it’ll ever happen, but I think voice acting would be really really fun. So like, or even like, if I was just gonna DM like a DnD campaign or whatever – just making a bunch of silly voices. I feel like I can hop around a bunch of places now so, that’s really fun.” (Participant 110)
- “Maybe it’s not as a unique situation as I think it is sometimes, but like, I don’t, I would say I, like, don’t really experience dysphoria as much as I, like, experience gender euphoria. Or, like, if I do experience dysphoria it’s less because of like, ‘oh, it makes me feel bad’ as like, ‘oh, someone perceives this thing that I’m indifferent to and their reaction makes me feel dysphoric.’ So, I’m like, and then trying to find the right balance of like, okay, yes, like, does, am I doing this because I makes me euphoric or am I doing it to like, get rid of how other people make me feel? Um, and, so I try to like, like – before I make a decision about what my next steps are, I’m like, I don’t know. Like I said, basically I’m happy and so far, the answers have been yes.” (Participant 110)