**Original Article**

# GENDER PERCEPTION BY ACOUSTIC SPEECH CHARACTERISTICS AND PITCH VARIABILITY

Eduardo BARBUIO[*]
Suzana Ferreira PAULINO[**]

▪ ABSTRACT: The research aimed at phoneticaly examining the speech of 14 men, 7 who declared themselves to be gay and 7 self-declared heterosexuals. The audios of these men´s voices were submitted to tests of perception and judged by evaluating listening lay judges. The theoretical assumptions of Variationist Sociolinguistics by Labov (2008 [1972]) and Eckert (1989, 1997, 2000, 2003, 2005, 2012; ECKERT; MCCONNELL-GINET, 2010) and Speech Perception, carried out by Gaudio (1994); Smyth, Jacobs and Rogers (2003); Levon (2007); Campbell-Kibler (2011), among others, were used. Significant greater averages of pitch variability among gay informants were also verified. In most aspects, the averages of homosexual informants were closer to the averages of gay informants participating in English-language surveys than the averages presented by the heterosexual informants. Thus, due to the similarities of results found in some surveys, it seems acceptable to affirm that there are some universal typical aspects that characterize a "gay speech".

▪ KEYWORDS: sociolinguistics; linguistic variation; linguistic perception; phonology; gay speech.

## Introduction

The present investigation analyzes a phenomenon of variation that Sociolinguistics adopts when working with legitimate speech data, produced by gay speakers. The objective was to research the mechanisms that regulate variation, how it interacts with the other elements of the linguistic system and the social matrix in which it occurs, and how this variation can lead to changes and phenomena in the language.

According to Mollica (2008), Sociolinguistics is responsible for investigating the degree of stability or mutability of the variation, for diagnosing the variables that have a positive or negative effect on the emergence of alternative linguistic uses and

[*] Universidade Federal Rural de Pernambuco (UFRPE). Recife – PE - Brazil. eduardo.barbuio@ufrpe.br. ORCID: 0000-0002-2891-0095.

[**] Universidade Federal Rural de Pernambuco (UFRPE). Recife – PE - Brazil. suzana.paulino@ufrpe.br. ORCID: 0000-0002-9488-8455.

for predicting their regular and systematic functioning. A sociolinguistic study aims at describing a particular phenomenon of language use, aiming to analyze linguistic variants, used by the same community of speakers, calculating the influence that each factor, internal or external to the linguistic system, can exert in the realization of certain variants. Thus, sociolinguistic analysis seeks to establish the relationships between the variation processes that are observed in the language.

To a large extent, the language denounces who its speakers are, their geographic origin, age group, their cultural insertion (through the level of mastery of the standard variety), attitudes towards certain groups of speakers, the social value that certain forms incorporate, and the importance of these values for issues regarding the identities of and among speakers. In our society, it is common the idea that from hearing the voice of speakers, numerous characteristics can be perceived, such as: sex, age group, emotional state, attitudes, social identity, etc. The speech characteristics of a particular individual can, subtly or openly, convey information about their association in certain social groups.

Therefore, we raised some questions, guiding the research:

1. Can the judges (lay listeners) perceive the sexual orientation of the speakers (informants, homosexual men and heterosexual men) from hearing their voices?

2. Do these lay judges better perceive the sexual orientation of speakers who have the same sexual orientation as theirs?

3. Is it possible to identify some acoustic peculiarities in the speech of homosexual and heterosexual men that differentiate their voices?

In Brazil, there are still few studies related to language issues that seek to address problems involving sexuality. The objective of this research was to evaluate the existence of phonetic characteristics of speech read by male speakers that can be used to identify them as of gay or heterosexual sexual orientation from the variability of the pitch in the read speech of 14 men from Recife, separated into two large groups. To better understand these phonetic characteristics, the audio recording of the voice of these men was subjected to perception tests and, later, judged by lay listeners. With this methodology, we aimed at assigning values of sexual orientation to the speech of each informant, and, based on the perceptions of these lay listeners, such acoustic characteristics were analyzed.

Our hypothesis is that the 75 listeners (lay judges) should be successful in their attempts to perceive the sexual orientation of the informants, when listening to the recorded excerpts of speech. This is based on the fact that previous studies have already proved that it is possible to identify the sexual orientation of speakers through voice perception tests (GAUDIO, 1994; LINVILLE, 1998; ROGERS; SMYTH, 2003; MUNSON; MCDONALD; DEBOE; WHITE, 2006; LEVON, 2007; TRACY; BAINTER SIERRA; SANTARIANO, 2015). We are also based on the idea that there will probably be better judgment proficiency when each set of judges evaluates the speech of the group of informants who have the same sexual orientation as theirs. To seek these answers, we relied on the theoretical assumptions on Sociolinguistics Variation of Labov (2008 [1972]) and Eckert (1989, 1997, 2000, 2003, 2005, 2012;

ECKERT; MCCONNELL-GINET, 2010), and on speech perception tests, inspired by works of this type, carried out, among others, by Gaudio (1994), Smyth, Jacobs and Rogers (2003), Levon (2007), Campbell-Kibler (2011), Lopes (2012) and Tracy, Bainter Sierra and Santariano (2015).

## Linguistic variation and speech from the perspective of gender identity

Sociolinguistics focuses on the study of the language in use among individuals from speech communities, with attention to a type of investigation that correlates linguistic and social aspects. This science operates in the universe that emerges from language and society, turning its attention to concrete linguistic uses, mainly those of a heterogeneous character. In sociolinguistic works developed in English-language research, the term sociophonetics is used as a synonym to define research with a theme similar to the pioneering works developed by Labov (FOULKES; DOCHERTY, 2006). These sociophonetic studies in English focus on phonetic and phonological aspects and other social characteristics, such as speech peculiarities and the social environment in which the speaker interacts, having a particular interest in understanding the origins and in the development of processes of variation and s. linguistic change. Therefore, these sociophonetic variations refer to how the phonetic and phonological variations and aspects can be related to social factors. Among the factors, we can mention those of gender, age group, ethnicity, geographic origins, affiliations with certain groups, social class and speech style (FOULKES; DOCHERTY, 2006).

Sociophonetic variations refer to the sound structures of the language in relation to the variations found in a given society, in which the individual relates, or in a given social group in which he is inserted, or to which he is affiliated (MUNSON, 2007). Thus, certain linguistic peculiarities can become marks of differentiation of social groups, even if they are not necessarily used by all members of the group. In other words, such linguistic particularities may not even be necessarily exclusive to certain social groups, and only used by the elements of this set (ROGERS; SMYTH, 2003).

The dynamics of languages can be perceived through diverse heterogeneous manifestations in different speech communities. According to Labov (2008 [1972]), the concept of speech community should not be understood only as a certain group of people who speak exactly the same way, but rather, as speakers who share linguistic traits through which it is possible to distinguish their group from others; and communicate relatively more among their group than with others and, mainly, share attitudes and norms regarding the use of language. The idea that an individual's sexual orientation can be perceived from his speech is quite popular in our society. It is even said that whoever has a good perception to recognize whether a certain person is gay, from his speech, has an accurate 'gaydar'. The term arose from the combination of the English words gay and radar, thus forming the word gaydar. This term started to be used by homosexual Americans and today it is used by gay communities around the world.

Gaydar would be the set of perceptual skills that someone would use to find out if a certain person, whose sexual condition is unknown, would be gay or not, based on the observation of their habits, behavior, style and appearance. This set of behavioral manifestations includes elements such as clothes, gestures, haircuts, the use of accessories and other characteristics, with the voice being considered the most evident trait for the identification of sexuality (ZWICKY, 1997).

Speech transmits a lot of information that allows a listener who is familiar with these characteristics, to identify the speaker by means of certain acoustic peculiarities (MUNSON, 2007). Speech signals can also carry messages about social groups in which individuals participate, and they can also provide signals about the sexual orientation of speakers. According to Lakoff (1987), if a man makes use of characteristics that are generally attributed to the speech of women, this speaker can be perceived as a gay man. To the author, an example of this phenomenon would be in the fact that women have greater variability in intonational contour, such characteristic being one of the attributes of female speech in most languages.

However, this thought by Lakoff is not a consensus, being discredited by many researchers. Issues related to research on speech perception and sexual orientation may present misconceptions that people who declare themselves to be part of a certain sexual orientation, certainly speak in the same way, all presenting the same characteristics of voice production. According to Kulick (2000), it is necessary to prove that the acoustic characteristics of a person's speech, who declares himself to be of a certain sexual orientation, are present in the voices of all other people who declare themselves to be of the same orientation. Gay language, in particular, has been referred in a very vague way. There are people who equate gay speech to the characteristics of female speech. In popular culture, comedy programs, cartoons, internet memes, generally, the speech of gays is portrayed with a voice with very marked and evident female characteristics. In these environments, gay speech is introduced in a caricatured way, presenting characteristics such as stretching, oscillating intonations and speech reproduced with a high fundamental frequency, among other characteristics that refer to the voice of women.

However, the idea of what characterizes gay speech has been debated in different surveys in recent years. Some scholars have considered specific linguistic characteristics that suggest a gay way of speaking, which in English has been referred to as "gay accent", which in Portuguese would be translated as "sotaque gay". In works carried out by researchers such as Gaudio (1994), Linville (1998) and Smyth, Jacobs and Rogers (2003), the alleged gay speech, referred to as gay accent, presents linguistic peculiarities that can be perceived in the lexicon, discourse and phonetics.

Currently, there is a tendency for a new perspective in relation to the processes of identity construction that make up the individual and their implications for the construction of social groups and society. Thus, investigating the perception and linguistic characteristics, present in the speech of specific groups of gay and heterosexual men, represents the interest in discussing current fundamental issues of

Sociolinguistics and in debating the social meaning of variation. Researchers' interest in how sexual orientation is perceived guided this research. In turn, the scarcity of academic works, related to investigations about the speech of gay and heterosexual men in the studies of Variationist Sociolinguistics, in addition to the lack of research with an emphasis on phonological and perceptual aspects in Portuguese, justifies the relevance of this work.

According to Lopes (2012), sociolinguistic studies, especially sociophonetics, consider social factors to be very relevant in speech perception. The production of certain linguistic variables highlights the social variables of the speakers. On the other hand, the social attributes related to a speaker play an important role in the judgment of listeners during a perception task. Spoken language carries strong identifying characteristics of members belonging to a certain social group, and this is a behavior common to all individuals.

Variability is one of the characteristics inherent to human speech; there are not two voices exactly identical. Linguistic variation is an integral part of the universe of social relations, through which speakers build a social world, are inserted, relate, and interact in (CAMPBELL-KIBLER, 2009). Linguistic traits differentiate speech communities, and it is in this context that the peculiarities of the voices of speakers that connect linguistic patterns with social factors of certain groups are developed (ECKERT, 2003; CAMPBELL-KIBLER, 2007). All individuals belong to at least one speech community, and it is the use of linguistic variations and norms that affiliate individuals in a community (RYAN; GILES; SEBASTIAN, 1982). As a product of social and cultural behavior, the language suffers variations, according to the environment in which it is inserted. Because of the diversity and heterogeneity of the language, Tarallo (2007) explains that the sociolinguistic theory aims at analyzing and systematizing the different linguistic variants used by the same linguistic community. It is for this reason that, for sociolinguistic studies, the object of study is the speech community and not just the individual.

Among Sociolinguistics studies, in the same way as in other social sciences, no social variable is totally separated from another; the sex/gender variable is, in fact, a broad label that covers different social and stylistic nuances (ECKERT, 1997). Thus, the variable sex has often been called "sex/gender", since it encompasses much more than the biological dimension. It is common for the presentation "sex/gender" to be used to consider the social roles played by men and women or, in other words, the way in which gender identity constructions, in this case, female or male, run through linguistic issues. This binary representation brings a challenge for the studies of Sociolinguistics. The traditional sociolinguistic approach has presented a bipolarized society, regarding gender, in which there are only men and women. This concept shows itself to be polarized, not only in a more traditional dimension, which includes the biological perspective of being, but also in that it involves its social perspective. It is this way that society has been represented in sociolinguistic samples.

According to Eckert and McConnell-Ginet (2010, p. 10), in order to understand gender as a social construction, it is necessary to consider that "gender is not something we are born with, nor is it something we have, but rather something we do or how we operate". We can, therefore, speak of a gender performance, and not limit ourselves to understanding gender through the bias of a purely biological perspective. Nowadays, there are other concerns in society regarding discussions around gender. And the relevance of coding the gender variable in search of a better understanding of the social representations of gender is certain. This is because, if societies change, it is necessary that the focus of studies, involving the relations between language and society, also evolve, and, thus, modify and adapt their perspectives and theoretical and methodological models.

Through speech it is possible to have impressions about relevant social characteristics of the interlocutor. These impressions may vary, including assumptions about the interlocutor's age, education level or sex/gender. Thus, only through hearing the interlocutor's voice, can an identity be associated with such characteristics. It would also be possible to consider the emotional or psychological state of the speaker. That is, to detect the interlocutor's mood condition; as being in a moment of nervousness, anxiety, excitement or unhappiness.

In recent years, research on variation has devoted more attention to the concept of social meaning, that is, to the idea that speakers and listeners make use of certain linguistic characteristics to shape social situations and relationships in which they participate. The link between social positioning and linguistic choices has been established since the early years of sociolinguistic research (LABOV, 1963), the understanding about social meaning has expanded following the evolution of society.

Inherent in this idea of building social relationships, there is the thought that, for all individuals inserted in a society, whether in the condition of speaker or listener, linguistic variation is connected to the perception of various aspects of social structures. Not only are linguistic behavior and other social structures related, but this is because speakers and listeners are mentally connected to such perceptions, whether consciously or not. Therefore, based on these social perceptions, there is an assessment and a position according to which the judgments of individuals' attitudes take place (CAMPBELL-KIBLER, 2007). Most of the evidence for the existence of a link between social meaning and variation occurs through studies of linguistic production, which documented the correlations between variations and social categories (ECKERT, 2000; LABOV, 1966).

One of the precursor research works was developed by Labov (1966), related to the study of English spoken in New York City. Assuming that linguistic variation is structured by the style and social class of the speakers and that the scale of formality (style) is connected to the individual's social condition, the researcher conducted an experiment in which five New York women had their voices recorded when reading a short text. As a subsequent step in the experiment, excerpts of the reading that contained the different intended linguistic variations were selected from among the recordings.

These excerpts with the recording of the voices were exposed to 112 listeners, New Yorkers, who played the role of judges. The listeners were of various ages, ethnicities, socioeconomic classes and sex.

Results indicated that the variants favored by the most privileged social classes received higher judgments, on the scale of occupational adequacy, than the variants favored by the speakers of lower socioeconomic status. This correlation was reproduced in all observed social classes and ethnic groups. From the results obtained, it can be concluded that the social stratification of the English language spoken in New York City is very ingrained, being well recognized by members of the linguistic community.

According to Gibson (1991 [1977]), perception can be understood as an extraction of information about things in the world. Therefore, perceiving means extracting relevant data and information about the events, which makes the listener able to make a judgment about what is perceived. Also for Fiske and Neuberg (1990), individuals, when forming impressions about others, use a cognitive pattern, which involves a social category from which the individual characteristics are perceived. Social categories such as sex/gender and age group are perceived quickly when listening to a speech excerpt.

According to Edwards (1999), perception can be considered a filter through which the sensory data are, at first, analyzed, and then recorded. Therefore, it is necessary to consider the context of production in which the individual is inserted and the unique set of experiences that this individual has. Thus, the social meaning that the group members have in common, from the idea of stereotypes to the sharing of their own culture and speech, plays an important role. Still within this perspective, Campbell-Kibler (2007), contributes to the hypothesis that individuals from a given speech community attribute and use social meanings to perceive and make use of their language.

## Acoustic Phonetics

Acoustic phonetics studies speech sounds based on their physical properties, describing and quantifying them, and showing how the quality of these sounds is related to the way they are produced. This study is processed on the speech chain, that is, through the analysis of sound waves. Acoustic analysis is an objective analysis that makes use of computer programs and that, in Brazil, has achieved greater use and development in recent decades, when studies in the area have become more comprehensive since the development of new technologies. Each individual, when producing the movements necessary for speech, has unique characteristics that make his speech a unique acoustic production.

When performing the acoustic analysis of speech, it is possible to identify characteristic features of the unique production of each speaker. Through graphic elements and numerical and statistical results, it is possible to carry out various analyses

of acoustic productions, even if they happen in a very small fraction of time, due to the dynamics of the information that occurred during speech. A sound is not only a production by the speaker, it is also a physical entity, which is perceived by listeners.

On the other hand, studies of acoustic phonetics focus on the physical properties of sounds, such as: length, fundamental frequency, intensity, etc., which, among others, are determining factors for a sound to be heard and perceived as different from others (CRYSTAL, 1988). Although there is an Articulatory Phonetics and an Acoustic Phonetics, there is a close relationship between the articulatory and acoustic properties of speech sounds. The fact is that the acoustic properties derive from the articulatory properties, that is, the movement of the articulators (jaw, tongue and lips) generates changes in the formonic frequencies, which are, therefore, conditioned to the position of those at the moment of the production of a given sound. It can be said that the acoustic signal represented in the spectrogram is the result of the total configuration of the vocal apparatus during the production of a sound.

**Fundamental frequency (pitch)**

One of the most basic physical characteristics of a sound is its fundamental frequency, which is characterized by the number of times that air particles vibrate in a given time interval; that is, it is the repetition frequency of a complex sound wave (LADEFOGED, 1967). Its measurement is made in cycles per second, which correspond to the speed at which a waveform is repeated per unit of time (COUPER-KUHLEN, 1986).

According to Braid (2003), the fundamental frequency of the voice, usually also referred to by the acronym F0, is the smallest periodic component resulting from the vibration of the vocal cords and the first frequency produced in the glottis. The fundamental frequency of the vocal cords is determined by a complex interaction between length, mass and tension (COLTON; CASPER, 1996). Lehiste (1970) agrees with the authors and considers that subglottic pressure and vocal cord lubrication also play an important role in determining the fundamental frequency, in addition to the vocal fold mass, length and tension.

At the perceptual level, this frequency represents, for listeners, the acoustic correlate responsible for the perception of the melody, that is, it is perceived as the melodic pitch of the voice, or tone (KENT; READ, 1992). The fundamental frequency (F0) is considered the most important of the parameters for the perception of pitch (high or low sounds) and also the intensity (loud or soft sounds) of voices. The higher or lower the frequency, the higher and lower the pitch and intensity of the sounds, respectively. Regarding the perception of fundamental frequency (F0), Braid (2003, p. 51) considers that "in speech analysis, the repetition rates of periodic patterns in a waveform are called fundamental frequency, however, perceptually, this auditory

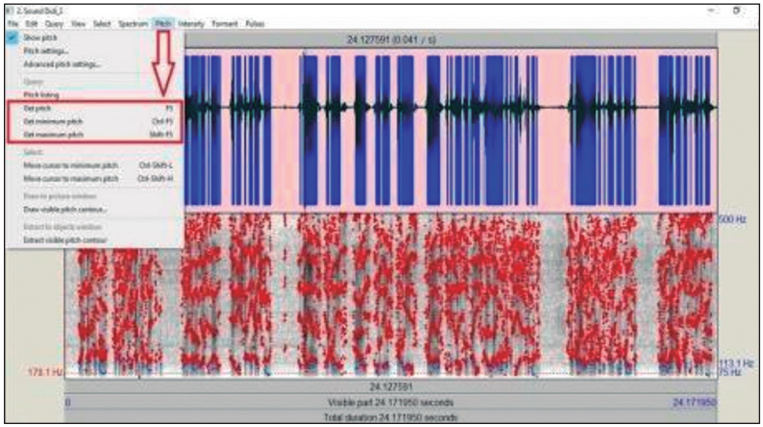
impression it's called a pitch. The pitch corresponds to the sensation of low or high sound, and its scales".

Therefore, in our research, we refer to the pitch of the sounds (high or low) as pitch. Hertz is the unit of measurement used to measure sounds and is represented by the symbol Hz. It is important to notice that, when we refer to the pitch values in Hz, they will appear through the symbol F0. People with voices within a higher range are considered to have a high pitch, therefore, those with lower voices, low pitch. Therefore, the sounds of lower pitch, or lower values of F0, are lower, as in the case of male voices, which generally have an average pitch of around 120 Hz. Female voices have a higher pitch, with average values of 230 Hz F0 (KENT; READ, 2015). In other words, the F0 of the female voice is generally double that of the male. This difference is due to the greater amount of vibrating mass being greater in men, due to the greater volume of their vocal chords, which causes them to vibrate at a slower speed, generating less glottic cycles per second.

Regardless of the personal voice characteristic (low or high), people change the pitch during their speech, as it is responsible for the intonation. Several authors, including Cruttenden (1986), Pierrehumbert (1987) and Moraes (1993) consider pitch as the most important prosodic characteristic of intonation. Every speaker, when uttering his voice, naturally produces pitch variation. This happens due to the different tones that are used by the speakers to express themselves. When performing the analysis of the graphic plot, which is generally referred to as pitch contour curves, the instantaneous values of the fundamental frequency as a function of time are found (BRAID, 2003). We believe that there may be a certain relationship between the results of the perception tests, answered by the judges, and the pitch characteristics of our informants' voices. In this study, we evaluated the overall average of the pitch, as it is a parameter used in surveys conducted in English with gay and heterosexual informants. We also verified the average of variability, by measuring the lowest and highest pitch values, of the informants' voices.

Using the variability parameter, we seek to verify whether our results are similar to those found by Munson, Jefferson and McDonald (2006), who, in their research, found extreme averages of F0 values in the speech of gay informants, with much higher peaks and minimum values well below the averages presented by heterosexual informants. It is, therefore, the characteristics called by Kulick (2000) "roller coaster intonation" which would be peculiarities of pitch variability, found in the speeches of women with voices perceived as higher. In all production analysis, we used the acoustic analysis and speech synthesis software called PRAAT (BOERSMA; WEENINK, 2021). To obtain the average pitch values and the minimum and maximum values of excerpts of each participant's speech, we used the pitch analysis feature available in the "PITCH" menu of the PRAAT software, with the 'get pitch' marked in blue, as we can see in Figure 1:

**Figure 1** – Procedures for analyzing the average and maximum and minimum pitch values



**Source:** Authors' elaboration.

The values of the pitch general average, minimum, maximum and variability values were obtained from the verification of the voices of each of the 14 informants. Then, we obtained the averages presented by the 7 informants that make up the group formed by gay men and the other 7 that make up the group of heterosexual men. After that, we tried to understand if there are significant differences in pitch between these groups. Another of our objectives was relating these measures to the results of the sexual orientation perception tests.

## Methodology

Our research is characterized as a descriptive study, since its central objective was to identify the possible relationship between certain characteristics of acoustic production, found in the speech of the informants and the perception that the listeners (lay judges) had about the sexual orientation of these informants (homosexual or heterosexual). These data were obtained from the hearing, carried out by lay judges, from excerpts read by our informants, and recorded in audio.

At first, data was collected from 14 informants who agreed to participate in the work and voluntarily authorized to have their voices recorded in audio. These recordings involved the reading of an excerpt lasting approximately 35 seconds. Among all informants, 7 declared themselves to be exclusively heterosexual and the other 7 to be exclusively homosexual. It was revealed to the 14 informants that the research would aim at perceiving the sexual orientation of each one, through the hearing of their speeches, after the recordings had been made. The 14 informants are residents of Recife - PE; born in the city, where they spent most of their lives.

In a second stage of the research, 75 lay judges participated. The judges voluntarily consented to listen to the excerpts of the voices recorded by the 14 informants and to assign values to these recordings, according to their perceptions regarding the sexual orientation of the informants. The 75 judges were divided into three groups. The first made up of 25 self-declared exclusively heterosexual men, the second by 25 other self-declared exclusively gay men, and the last made up of 25 women, regardless of their sexual orientation.

The collection of the voices of the 14 informants was carried out in a room, in an environment with a lower than 50 dB noise, and the voices were recorded using a pedestal table microphone, model AC00040ML, with anti-noise technology, sensitivity 38dBV / Pa, frequency range of 50 - 16kHz (+/- 3db) and sampling rate up to 48 kHz, connected via USB cable, to a DELL Inspiron 14 Model 5000 notebook, with integrated sound card. The recording was done using the PRAAT 4.1.44 software (BOERSMA; WEENNINK, 2021), at a sampling rate of 44,100 KHz. Informants were asked to read the same excerpt of text, at natural speed, as if they were reading to a group of close friends who were present in the room. The parts of the recording selected for the research corpus were from the Laver protocol (VPAS) translated/ adapted by Camargo and Madureira (2008) to Portuguese which, based on the work of Laver *et al.* (1981), created a reference voice quality protocol in the phonetic and speech analysis of Brazil.

For the statistical analysis of the perception test, we considered as a dependent variable, the degree of attribution on the sexual orientation of the individual who produced the stimuli provided to the judges. The values of this variable formed a gradual scale from 1 to 5, with "1" being the value assigned if the informant sounded more heterosexual to the judges, and "5", if the informant sounded more gay, with the other numbers at the intersection of these two extremes.[1] Thus, we have a continuous variable that can have values between 1 and 5. As we establish alternative hypotheses that (i) gay judges would be more proficient in identifying gay informants; (ii) heterosexual judges would be more proficient in recognizing heterosexual informants; (iii) women would be proficient in the perception of the two groups, the main independent variable in our research is the sexual orientation/sex (sexual orientation, in the group of men vs women) of the judges.

Furthermore, for statistical analysis, we initially verified the responses for all gay informants and, later, for all heterosexual informants, in order to assess the proficiency

[1] (1) *Se o juiz tivesse certeza que se tratava de um informante heterossexual.*
If the judge was sure that he/she was listening to a heterossexual informant.
(2) *Se o informante parecesse heterossexual ao juiz.*
If the informant seemed heterossexual to the judge.
(3) *Se o juiz não pudesse identificar com clareza a orientação sexual do informante.*
If the judge could not clearly identify the informant's sexual orientation.
(4) *Se o informante parecesse heterossexual ao juiz.*
If the informant seemed heterossexual to the judge.
(5) *Se o juiz tivesse certeza que se tratava de um informante gay.*
If the judge was sure that he/she was listening to a gay informant.

of each group as established in the hypotheses. The table shows each variable and its levels for the two rounds:

**Chart 1** – Dependent and Independent Variables of the Sexual Orientation Perception Test

| Type | Description | Levels |
|---|---|---|
| **Dependent Variable** | Degree of attribution on sexual condition of the individual who produced the stimulus | 1; 2; 3; 4; 5. |
| **Independent Variables** | Sexual orientation | Gay man; heterossexual man; Women. |

**Source:** Authors' elaboration.

The software used in our statistical analysis of the perception tests was R, which is free and the most used by the statistical community. Graphs with values of the averages of the perception tests and bloxpots, with the values of perception of sexuality attributed to the informants by the judges, were also used, for a better presentation and discussion of the data collected. Regarding to oral production, we analyzed aspects close to those pointed out in the literature in English (LEVON, 2007; PODESVA, 2007; MUNSON, 2007; CAMPBELL-KIBLER, 2011; TRACY; BAINTER SIERRA; SANTARIANO, 2015), as the main distinguishing marks of the speech of gay and heterosexual men. According to the researched literature, one of the main points, in which characteristics of the speech of gay men differed from the speech of heterosexual men was in the pitch, the main aspects observed were the average and the variability. This was done by observing the maximum peaks and the minimum values, that is, the variability. The variability corresponds to the difference between the maximum and minimum frequency found in a given specific speech excerpt.

## Data Analysis and results

### Pitch analysis

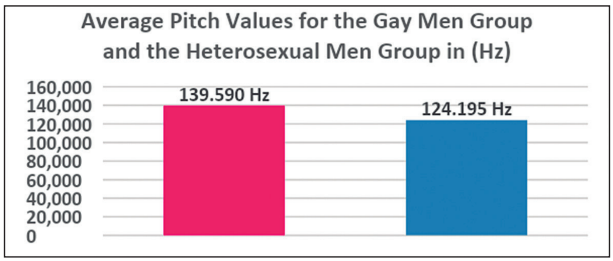
According to Kent and Read (1992), for listeners, the pitch is the acoustic correlate responsible for the perception of the melody, that is, it is perceived as the melodic pitch of the voice, also referred to by tone. In the surveys carried out with English-speaking speakers, which aimed to study the perception and characteristics of speech production of men identified as heterosexual and homosexual, the issue of pitch was the most frequently addressed. Regarding the aspects of the pitch, addressed in these studies,

almost all the researchers analyzed the average of the pitch value and its variability, through the mediation of its highest peaks and lowest production values.

Although some of these surveys did not find significant differences in relation to the average pitch of the informants (GAUDIO, 1994; LINVILLE, 1998; SMYTH; JACOBS; ROGERS, 2003; MUNSON; JEFFERSON; MCDONALD, 2006; MUNSON, 2007), it is considered this is a procedure to be taken into account in this research. Thus, we chose the procedure to be used among the parameters of analysis on aspects involving the speech of men, and those who seek to address the issue of sexual orientation. In addition, it is also worth highlighting the fact that we are not aware of analysis previously carried out, which included the pitch among the purposes of the investigations, with Portuguese speakers.

Thus, using the PRAAT software (BOERSMA; WEENINK, 2021), it was verified the average pitch values of the informants of the group formed by gay men and another composed by heterosexual men. Graph 1 shows the values observed in each of the two groups (pink for the group of gay men and blue for the group of heterosexual men):

**Graph 1** – Average pitch values of the group of gay men and the group of heterosexual men in (Hz)




**Source:** Authors' elaboration.

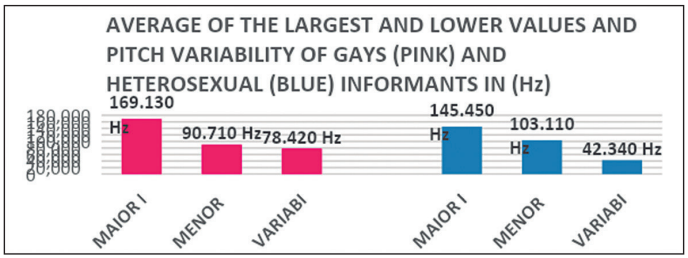
According to Kent and Read (1992), while the average pitch of the voice of a male speaker generally varies around 100 to 120 Hz, that of women is around 200 to 220 Hz. With values of 139,590 for the group of gay men and 124,195 for the group of heterosexual men, it can be said that the average pitch values of both are closer to what the authors consider by a male average. Therefore, even the gay group, which had a higher average, is still far from the female average. The average pitch for the gay group was about 11% higher than the heterosexual group average This difference is not very big from the averages found in other studies, in which the pitch averages of groups of gay and heterosexual men were compared. Gaudio (1994) observed a difference of 10% more, in the average of gay informants. In the research by Munson, Jefferson and McDonald (2006), gays also had a pitch average 7% higher than heterosexuals. The two researchers considered that these averages do not represent a relevant difference, and that they would have little influence on the perception of the sexual orientation of the informants in their research.

Due to the values observed in our analysis and, due to the fact that the average of the gay group presents a difference of about 11% greater than the average of heterosexuals, we also do not believe that the average pitch of our informants is an element that significantly differentiates the peculiarities of gay speech and heterosexual speech, and, therefore, they probably do not exert great influence on the process of perceiving the informants' sexual orientation.

**Analysis of minimum, maximum values and pitch variability**

Below, graph 2 shows the averages of the highest values; the averages of the lowest registered values, and the averages of variability, which represents the lowest value, subtracted from the highest value, presented by the two groups of informants:

**Graph 2** – Averages of the highest and lowest values and pitch variability of gay (pink) and heterosexual (blue) informants (Hz).




**Source:** Authors' elaboration.

When observing the values shown in graph 2, it can be noticed that the averages of the groups of gay and heterosexual informants showed different values in the three observed parameters. The average highest pitch value in the gay group was 169,130 Hz, against 145,450 Hz for heterosexuals. It is, therefore, a difference of about 14% greater for gays, which allows us to conclude that the voices of gay informants, participants in our research, presented peaks a little higher than the voices of heterosexuals. On the other hand, the average value of the lowest pitch presented by the gay group was lower than that of the heterosexual group (average of 103,110 Hz for heterosexuals versus 90,710 Hz for gays). Such values were about 12% lower, which demonstrates that, in some moments of the recordings used in our perception test, gays presented subtly lower voices than those of heterosexuals.

The average of variability, presented by the gay group, was about 46% higher than that of the heterosexual group, with averages of 78,420 Hz against 42,340 Hz. Therefore, the highest and lowest pitch values, observed in the voices of gay informants, showed an average of variability considerably greater than that of heterosexuals. Kulick (2000) calls the voices with pitch variability and the presence of low averages and high peaks

"roller coaster intonation", characteristics most observed in the peculiarities of female voices. Although the average pitch values found in the voices of gay speakers are lower than the average pitch values attributed to female voices, we can consider that the intonation of a roller coaster is a peculiar characteristic of the speech of the group of gay informants in the research. Their speeches, however, are not as high-pitched as female voices. Similarly, roller coaster intonation in voices not as high as that of women were also characteristics of production found in the speech of informants of the group of homosexuals in Smyth, Jacobs and Rogers (2003).

The work of Munson, Jefferson and McDonald (2006) also concluded that some gay informants showed extreme pitch variability; depressions with lower values and peaks higher than the average of heterosexual informants. However, the researchers considered that the number of participants involved in their research was very small, and that this characteristic was observed only in the speech of 3 informants. Even so, in a subsequent study, carried out shortly afterwards, with a larger number of informants, the results found in Munson (2007) did not confirm this supposed peculiarity of "gay speech".

In our research, we consider that the so-called roller coaster intonation (observed in the speech of gay informants) - with a rate of variability almost 50% higher than among heterosexual speakers - represents a peculiar characteristic of the speech of the group of gay informants participating in our research, since all homosexual individuals had this same characteristic. We also consider that this characteristic in gay men's speech was relevant to the judges' value assignments, when performing the sexuality perception test. And, by confirming the results found in surveys carried out with other informants who are also gay, English-speaking (SMYTH; JACOBS; ROGERS, 2003; MUNSON; MCDONALD; DEBOE; WHITE*,* 2006), it is possible that the so-called roller coaster intonation is a more universal characteristic, typical of gay speech communities.

## Final considerations

Discoveries regarding the peculiarities of the language used by people of different sexual orientations have been made by linguistic research works in recent years (LEVON, 2007; PODESVA, 2007; MUNSON, 2007; CAMPBELL-KIBLER, 2011; TRACY; BAINTER SIERRA; SANTARIANO, 2015).

This study aimed at verifying whether informants, of different sexual orientations, would present specific acoustic peculiarities in their speeches. In confirming this hypothesis, the next step was trying to understand whether these acoustic peculiarities could be attributed to the particular speech characteristics of the two groups chosen for the research.

Therefore, we raised the following question: Is it possible to identify some acoustic peculiarities in the speech of heterosexual and gay men that differentiate their voices? In our results, we found some peculiarities typical of the groups of each sexual orientation.

Regarding the pitch, the average variability presented by the gay group was about 46% higher than that of the heterosexual group, with averages of 78,420 Hz versus 42,340 Hz. Thus, the highest and lowest pitch values, observed in the voices of gay informants, showed an average of variability considerably greater than that of heterosexuals.

It was observed that it is possible that the so-called roller coaster intonation is a more universal characteristic, typical of gay speech communities, considering that the affirmation of a universal characteristic may need more experiments in the area. However, the fact of confirming previous studies is an indication/evidence of importance for studies from the perspective of research.

Linguistic variation is inherent to human language and results from several factors involved in the chosen linguistic form. The production of certain variables highlights the speaker's social variables. The spoken language carries strong identifying characteristics of members of a social group or a speaking community. The results point to the possibility that future research will address more attention to investigations that focus on some specific sounds, produced by gay and heterosexual informants, in terms of production and perception. This seems to be a promising field for scholars in the field, in the constant search for a better understanding of the relationship between speech and the perception of people's sexual orientation.

BARBUIO, E.; PAULINO, S. Percepção de gênero por meio de características acústicas da fala e variabilidade do pitch. **Alfa**, São Paulo, v.65, 2021.

- *RESUMO: A pesquisa objetivou analisar a percepção de gênero foneticamente, pela variabilidade do pitch, na fala de 14 homens, 7 que se autodeclararam gays e 7 autodeclarados heterossexuais. Os áudios foram submetidos a testes de percepção e julgados por ouvintes juízes leigos. Utilizaram-se os pressupostos teóricos da Sociolinguística Variacionista de Labov (2008 [1972]) e Eckert (1989, 1997, 2000, 2003, 2005, 2012; ECKERT; MCCONNELL-GINET, 2010), e testes de percepção da fala realizados por Gaudio (1994); Smyth, Jacobs e Rogers (2003); Levon (2007); Campbell-Kibler (2011); entre outros. Médias maiores de variabilidade do pitch dos informantes gays foram verificadas. Na maioria dos aspectos, as médias dos informantes homossexuais da pesquisa, aproximaram-se mais das médias dos informantes gays participantes das pesquisas em língua inglesa que das médias apresentadas por nossos informantes heterossexuais. Assim, devido às semelhanças encontradas nos resultados de algumas pesquisas, parece plausível afirmar haver alguns aspectos universais característicos e típicos de uma "fala gay".*

- *PALAVRAS-CHAVE: sociolinguística; variação linguística; percepção linguística; fonologia; fala gay.*

## REFERENCES


BOERSMA, P.; WEENINK, D. **Praat:** doing phonetics by computer [Computer program]. Version 6.0.16. Available at: http://www.praat.org/. Access on: 16 ago. 2021.

BRAID, A. C. M. **Fonética Forense:** tratado de perícias criminalísticas. Campinas: Millenium, 2003.

CAMARGO, Z.; MADUREIRA, S. Voice quality analysis from a phonetic perspective: Voice Profile Analysis SchemeProfile for Brazilian Portuguese (BP-VPAS). *In*: CONFERENCE ON SPEECH PROSODY, 4., 2008, Campinas, **Abstract Book and Proceedings** [...], Campinas: Capes, Fapesp, CNPq, 2008. p.57-60. v.1.

CAMPBELL-KIBLER, K. Intersecting variables and perceived sexual orientation in men. **American Speech,** New York, v.86, n.1, p.52-68, 2011**.**

CAMPBELL-KIBLER, K. The nature of sociolinguistic perception. **Language Variation and Change**, Cambridge, v.21, p.135-56, 2009.

CAMPBELL-KIBLER, K. Accent, (ing), and the social logic of listeners perceptions. **American Speech**, New York, v.82, n.1, p.32-64, 2007.

COLTON, R. H.; CASPER, J. C. **Compreendendo os problemas da voz.** Porto Alegre: Artes Médicas, 1996.

COUPER-KUHLEN, E. **An Introduction to English prosody**. Baltimore: Edward Arnold, 1986.

CRUTTNDEN, A. **Intonation.** Cambridge: Cambridge University Press, 1986.

CRYSTAL, D. **Dicionário de Linguística e Fonética**. Rio de Janeiro: Jorge Zahar, 1988.

ECKERT, P. Three waves of variation study: the emergence of meaning in the study of sociolinguistic variation. **Annual Review of Anthropology,** Palo Alto, n.41, p.87-100, 2012.

ECKERT, P. Variation, convention and Social Meaning. *In:* ANNUAL MEETING OF THE LINGUISTIC SOCIETY OF AMERICA, Oakland, CA, **Proceedings** [...], Oakland, CA, 2005. Available at: http://www.justinecassell.com/discourse09/readings/EckertLSA2005.pdf. Access on: 16 ago. 2021.

ECKERT, P. The meaning of Style. *In:* ANNUAL SYMPOSIUM ABOUT LANGUAGE AND SOCIETY, 11., Austin, **Proceedings** [...], Austin: University of Texas, 2003. p.41-53.

ECKERT, P. **Linguistic Variation as Social Practice**. Hoboken: Blackwell Publishing, 2000.

ECKERT, P. Age as a sociolinguistic variable. *In*: COULMAS, F. **The handbook of Sociolinguistics**. Oxford: Blackwell, 1997. p. 151-167.

ECKERT, P. The Whole Woman: Sex and gender differences in variation. **Language Variation and Change,** Cambridge, v.1, p.245-268, 1989.

ECKERT, P.; MCCONNELL-GINET, S. Comunidades de práticas: lugar onde co-habitam linguagem, gênero e poder. *In*: OSTERMANN, A. C.; FONTANA, B. **Linguagem, gênero e sexualidade**: clássicos traduzidos. São Paulo: Parábola, 2010. p.93-107.

EDWARDS, J. Refining our understanding of language attitudes. **Journal of Language and Social Psychology**, Clevedon, v.18, n.1, p.101-10, 1999.

FISKE, S. T.; NEUBERG, S. L. A continuum of impression formation, from category-based to individuating processes: Influences of information and motivation on attention and interpretation. **Advances in Experimental Social Psychology**, San Diego, v.23, p.1-74, 1990.

FOULKES, P.; DOCHERTY, G. The social life of phonetics and phonology. **Journal of Phonetics,** London, v.34, n.4, p.409-438, October 2006.

GAUDIO, R. P. Sounding gay: Pitch properties in the speech of gay and straight men. **American Speech**, New York, v.69, n.1, p.30–57, 1994.

GIBSON, E. J. How perception really develops: A view from outside the network, *In:* GIBSON, E. J. **An Odyssey in Learning and Perception**. Cambridge: MIT Press, 1991. p. 411–491. Original from 1977.

KENT, R. D.; READ, C. **Análise Acústica da Fala**. Translated by Alexsandro Meireles. São Paulo: Cortez, 2015.

KENT, R. D.; READ, C. **The Acoustic Analysis of Speech**. San Diego: Singular Publishing Group, 1992.

KULICK, D. Gay and Lesbian Language. **Annual Review of Anthropology,** Palo Alto, v.29, p. 243-285, 2000.

LABOV, W. **Padrões Sociolinguísticos**. Translation: Marcos Bagno; Marta Scherre e Caroline Cardoso. São Paulo: Parábola, 2008. Original from 1972.

LABOV, W. **The Social Stratification of English in New York City**. Washington, D.C.: Center for Applied Linguistics, 1966.

LABOV, W. The social motivation of a sound change, **Word**, New York, v.19, p.273-309, 1963.

LADEFOGED, P. **Three areas of experimental phonetics**. Londres: Oxford University Press, 1967.

LAKOFF G. **Women, Fire and Dangerous Things.** Chicago: London: University of Chicago Press, 1987.

LAVER, J.; WIRS, S.; MACKENZIE, J.; HILLER, S. M. **A perceptual protocol for the analysis of vocal profiles**. Edinburgh: Edinburg University, 1981. p.139-55. (Work in Progress, 14).

LEHISTE, I. **Suprasegmentals**. Cambridge: The MIT Press, 1970.

LEVON, E. Hearing gay: Prosody, interpretation and the affective judments of men´s speech, **American Speech**, New York, v.81, n.1, p.56-78, 2007.

LINVILLE, S. E. Acoustic correlates of perceived versus actual sexual orientation in men's speech. **Folia Phoniactrica et Logopaedica**, Basel, v.50, n.1, p.35–48, 1998.

LOPES, L. W. **Preferências e atitudes dos ouvintes em relação ao sotaque regional no telejornalismo.** 2012. 141f. Thesis (Doctor in Linguistics) – Federal University of Paraíba, João Pessoa, 2012.

MCDONALD, E.; DEBOE, N.; WHITE, A. Acoustic and perceptual bases of judgments of women and men's sexual orientation from read speech. **Journal of Phonetics,** London, v.34, p.202-240, 2006.

MOLLICA, M.C.; Fundamentação Teórica: conceituação e delimitação. *In*: MOLLICA, M.C.; BRAGA, M. L. (org.). **Introdução à Sociolinguística**: o tratamento de variação. São Paulo: Contexto, 2008. p.9-14.

MORAES, J. A. A entoação modal brasileira: fonética e fonologia. **Caderno de Estudos Linguísticos**, Campinas, v. 25, p. 101-111, 1993.

MUNSON, B. The acoustic correlates of perceived masculinity, perceived femininity, and perceived sexual orientations. **Language and Speech**, London, v.50, n.1, p.125-142, 2007.

MUNSON, B.; JEFFERSON, S.V.; MCDONALD, E.C. The influence of perceived sexual orientation on fricative perception. **Journal of the Acoustic Society of America**, Melville, n.119, p.2427-2437, 2006.

MUNSON, B.; MCDONALD, E. C.; DEBOE, N. L.; WHITE, A. R. The acoustic and perceptual bases of judgments of women and men´s sexual orientation from read speech. **Journal of Phonetics,** London, v.34, n.2, p.202-240, 2006.

PIERREHUMBERT, J. **The Phonology and Phonetics of English Intonation**. Bloomington: Indiana University Linguistics Club Publications, 1987.

PODESVA, R. J. Phonation type as a stylistic variable: the use of falsetto in constructing a persona. **Journal of Sociolinguistics,** Hoboken, v.11, n.4, p.478–504, 2007.

ROGERS, H.; SMYTH, R. Phonetic diferences between gay- and straight – sounding male speakers of North American English. *In*: INTERNATIONAL CONGRESS OF PHONETIC SCIENCES, 15., Barcelona, **Proceedings** [...], Barcelona: Universitat Autonoma de Barcelona, 2003. p.1855-1858.

RYAN, E. E.; GILES, H.; SEBASTIAN, R. An integrative perspective for the study of attitudes toward language variation. *In*: RYAN, E.; GILES, H. (ed.). **Attitudes Towards Language Variation**: Social and Applied Contexts. London: Arnold, 1982. p. 1-19.

SMYTH, R.; JACOBS, G.; ROGERS, H. Male voices and perceived sexual orientation: an experiment and theoretical approach. **Language in Society,** Cambridge, v.32, p.329-350, 2003.

TARALLO, F. **A pesquisa sociolinguística**. São Paulo: Ática, 2007.

TRACY, E. C.; BAINTER SIERRA, A.; SANTARIANO, N. P. Judgments of self-identified gay and heterossexual male speakers: Which phonemes are most saliente in determining sexual orientation? **Journal of Phonetics**, London, v.52, p.13-25, 2015.

ZWICKY, A. M. Two Lavander Issues for Linguistics. *In*: HALL, K.; LIVIA, A. (ed.). **Queerly Phrased**: Language Gender and Sexuality. Oxford: Oxford University Press, 1997. p. 21-34.

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