

THE PENNSYLVANIA STATE UNIVERSITY  
SCHREYER HONORS COLLEGE

DEPARTMENT OF COMMUNICATION SCIENCES AND DISORDERS

THE EFFECT OF AGE ON THE PERCEPTION OF HEALTHY, AGING, AND  
DISORDERED VOICES

RACHEL TROTTI  
SPRING 2023

A thesis  
submitted in partial fulfillment  
of the requirements  
for a baccalaureate degree in Communication Sciences and Disorders  
with honors in Communication Sciences and Disorders

Reviewed and approved\* by the following:

Dr. Nicole Etter  
Associate Professor of Communication Sciences and Disorders  
Thesis Supervisor

Dr. Carol Miller  
Professor of Communication Sciences and Disorders  
Honors Adviser

\* Electronic approvals are on file.

## **ABSTRACT**

This study has been conducted with the goal of better understanding the terminology that older adults utilize while describing different voices. Ten participants were recruited to listen to ten different voice samples and then draw various conclusions about the age, sex, disorder severity, and personality of the speaker's voice. After each sample, the participants would estimate the individual's age, sex, quality of voice, and they were asked to describe both the voice and the personality of the speaker. The voice recordings used in this study included those that differ in biological sex, age, and level of voice disorder. Results were organized and arranged in word clouds and tables. The terminology utilized by our older participants appeared more negative as the level of voice disorder increased. This study, along with others, may be used to better understand how the presence of a voice disorder impacts the way an individual is perceived by the listener.

## TABLE OF CONTENTS

LIST OF FIGURES .....	iii
LIST OF TABLES .....	iv
ACKNOWLEDGEMENTS .....	vi
Chapter 1 : Introduction .....	1
Chapter 2 : Literature Review .....	3
The Anatomy of Voice.....	3
<i>Lungs &amp; Diaphragm/ Respiratory System</i> .....	3
<i>Larynx &amp; Vocal Folds/Phonatory System</i> .....	5
<i>Articulators/Resonance System</i> .....	7
Steps in Voice Production.....	8
<i>Respiration</i> .....	8
<i>Phonation</i> .....	8
<i>Resonance</i> .....	10
<i>Articulation</i> .....	12
What is a “Healthy Voice”? .....	13
Select Voice Disorders.....	14
<i>Spasmodic Dysphonia</i> .....	14
<i>Vocal Nodules and Polyps</i> .....	15
<i>Vocal Paralysis</i> .....	16
<i>Other Causes</i> .....	17
<i>Perception of a Communication Partner</i> .....	18
Chapter 3 : Methods .....	20
Purpose.....	20
Procedure .....	20
Chapter 4 : Results .....	23
Participants.....	23
<i>Sample 1: Young Female, Normal Voice</i> .....	24
<i>Sample 2: Young Male, Normal Voice</i> .....	25
<i>Sample 3: Older Female, Normal Voice</i> .....	27
<i>Sample 5: Mid-Aged Female, Mild Voice Disorder</i> .....	30
<i>Sample 7: Older Female, Moderate Voice Disorder</i> .....	33
<i>Sample 8: Older Male, Moderate Voice Disorder</i> .....	34
<i>Sample 9: Older Female, Severe Voice Disorder</i> .....	36
<i>Sample 10: Older Male, Severe Voice Disorder</i> .....	38
Chapter 5 : Discussion .....	41

*Perceptions based on age:* ..... 41  
*Perceptions based on severity:* ..... 42  
*Comparison to previously-collected younger adult perspectives:* ..... 44  
*Conclusion* ..... 46

Appendix A: Participant Demographics ..... 49

Appendix B: CAPE-V FORM ..... 50

**LIST OF FIGURES**

Figure 1: Anterior View of the Larynx.....	7
Figure 2: Source-Filter Theory .....	11
Figure 3: Places of Articulation.....	13
Figure 4: Sample 1, Voice Descriptors.....	24
Figure 5: Sample 1, Personality Traits .....	25
Figure 6: Sample 2, Voice Descriptors.....	26
Figure 7: Sample 2, Personality Traits .....	26
Figure 8: Sample 3, Voice Descriptors.....	28
Figure 9: Sample 3, Personality Traits .....	28
Figure 10: Sample 4, Voice Descriptors.....	29
Figure 11: Sample 4, Personality Traits .....	29
Figure 12: Sample 5, Voice Descriptors.....	30
Figure 13: Sample 5, Personality Traits .....	31
Figure 14: Sample 6, Voice Descriptors.....	32
Figure 15: Sample 6, Personality Traits .....	32
Figure 16: Sample 7, Voice Descriptors.....	33
Figure 17: Sample 7, Personality Traits .....	34
Figure 18: Sample 8, Voice Descriptors.....	35
Figure 19: Sample 8, Personality Traits .....	35
Figure 20: Sample 9, Voice Descriptors.....	37
Figure 21: Sample 9, Personality Traits .....	37
Figure 22: Sample 10, Voice Descriptors.....	39
Figure 23: Sample 10, Personality Traits .....	39

**LIST OF TABLES**

Table 1: Voice Sample Audio Clips .....	22
Table 2: Participant Demographics .....	23
Table 3: Voice Recording Descriptors .....	40
Table 4 : Voice Sample Descriptors (College-Aged Adults) .....	48

## **ACKNOWLEDGEMENTS**

I would like to express my gratitude to Dr. Nicole Etter who has allowed me to work within the Orofacial Physiology & Perceptual Analysis lab at Penn State which has taught me such valuable skills. Thank you to Dr. Carol Miller and the Schreyer Honors College for guiding me through the process of successfully conducting research and producing this thesis. In addition, I would like to thank my family and friends for their endless support as I completed this project. Without them, none of this would have been possible.

## Chapter 1 : Introduction

Voice is the term used to describe sound production created by a series of processes. It is the basis of verbal speech and sound production between humans. Biologically, the voice is the result of the multiple bodily systems functioning together to produce an auditory output. The word *voice* has a strong biological association; however, voice has many social implications. Voice changes the way in which humans communicate with others and the outcomes of communication. Voice allows us to convey all types of messages to other people. The process also reveals important information about the individual who is sending the message. Voice may reveal personal characteristics about the individual sending the message as well as their present emotions. Therefore, not only is the message significant, but the voice producing this message can influence its interpretation and effect. During the process of verbal communication, if one individual involved in a conversation has difficulty understanding another, it can create a miscommunication.

Voice can play an integral role in how individuals view themselves and affect their self-esteem. Misono et al. (2014) found that a significant number of individuals who have a voice disorder or condition experience distress due to their own perceived quality of their vocal output as well as external challenges (Misono et al., 2014). This may negatively affect an individual's self-esteem. Older adults who have been diagnosed with a voice disorder experience a higher rate of social isolation, depression, anxiety, and many other effects (Gois et. al, 2018). This demonstrates how voice disorders may have significant psychological or emotional effects. As a



result, individuals who have a voice disorder may seek treatment due to their voice disorders' impact on their mental health.

The treatment of voice disorders can often be a lengthy process due to the necessity for surgical and medical procedures or extended therapy. The length of treatment has social implications that may make treatment less accessible or inaccessible for specific socioeconomic groups. Another important consideration is that access to specialists who can help resolve the effects of voice disorders may be limited. Without local otolaryngologists, ENT's or speech pathologists, individuals who may have treatable symptoms or disorders may not be able to achieve optimal outcomes (Bertelsen et al., 2018).

How other individuals perceive our voices is another significant variable. Our voice can impact the way that others perceive our personality. This study was conducted with the goal of increasing our understanding of how older adults perceive different voices and how older adults describe personality traits of different speakers.

## Chapter 2 : Literature Review

### The Anatomy of Voice

#### *Lungs & Diaphragm/ Respiratory System*

The lungs are the primary organ of the respiratory system and are located within the thoracic cavity of the chest. The lungs supply the oxygen needed to begin voice production. The primary muscles of the lungs can be divided into two groups, the muscles of inspiration and the muscles of expiration. The muscles of inspiration are responsible for the process of inspiration, which is the action of the body taking air into the lungs. The diaphragm, the sternocleidomastoid, pairs of scalene muscles, and pectoralis major and minor are all muscles of inspiration (Stemple et al., 2018). However, there are various other smaller muscles involved in said process. The muscles of inspiration allow for the taking in of air from the environment which begins with the contracting of the diaphragm. The diaphragm is a muscle at the bottom of the thoracic cavity that contracts and expands the thoracic cavity. The downwards contraction of the diaphragm creates negative pressure within the thoracic cavity. The diaphragm draws in the air in for inspiration. When an individual inspires, air enters the lungs and is quickly filtered of all other gases besides oxygen. Once the lungs reach capacity, the diaphragm will contract upwards in order to return to its normal dome-like shape. As a result, air is forced back out of the lungs by the diaphragm and air pressure then increases to match that of the atmosphere. This process repeats to allow for continuous respiration. The primary muscles of forced expiration include the internal intercostal, the oblique muscles, the transverse abdominus, and the rectus abdominus (Stemple et al., 2018). Expiration forces the air out of the lungs and out of the body. The cycle of

inspiration and expiration is a repetitive cycle that is constant. The pressure produced by the lungs is then used to vibrate the vocal folds, allowing for the following steps in voice production.

When an individual is not using their voice, passive inspiration and expiration is employed. During quiet inspiration and passive expiration, the vocal folds remain in an abducted or open position. Quiet inspiration and passive expiration are influenced by the forces of gravity and the body automatically completes this process as it is involuntary. The main goal of non-speech related respiration is to regulate the exchange of gases throughout the entire body. The term passive refers to the lack of muscular effort needed to utilize passive expiration as the body naturally completes this process. The muscles of inspiration allow for the intake of air by expanding the thoracic cavity. The negative pressure created inside the lungs causes air to rush to the lungs during inspiration and then relax and return to their normal, resting position. The ribs, which surround and protect the lungs, are returned to normal positioning by gravity thus decreasing the size of thoracic cavity. The decrease in size creates high pressure inside the thoracic cavity. This causes air to rush out of the lungs which leads to passive expiration. In terms of the lungs during passive breathing, since they are elastic, they can be stretched during inspiration and deflated during expiration. After the completion of inspiration, the lungs return automatically to their typical positioning and air is forced from the lungs (Seikel et al., 2018).

During voice production, active breathing, also known as speech breathing, is used in order to supply adequate airflow. Speech breathing is a process that is voluntary therefore, humans can control when it is used. The key difference between speech breathing and quiet respiration is the differences between the lengths of inspiration and expiration. During active expiration, the muscles of expiration limit the size of the thoracic cavity which aids in pushing air out of the lungs. During speech breathing, the abdominal muscles are more actively involved

than in non-speech breathing to accommodate speech production. The abdomen allows for sufficient internal pressure to build up in order to support speech (Hoit, 1995). Non-speech breathing has a rate of 8-16 breaths per minute for an adult, with approximately equal times in inspiration and expiration (*Rapid Shallow Breathing*, n.d.). During speech breathing, inspiration accounts for 10% of respiration while expiration accounts for 90% which is due to speech production occurring during controlled exhalation. As a result, we take a significantly lesser number of breaths while we are speaking (Seikel et al., 2018).

### *Larynx & Vocal Folds/Phonatory System*

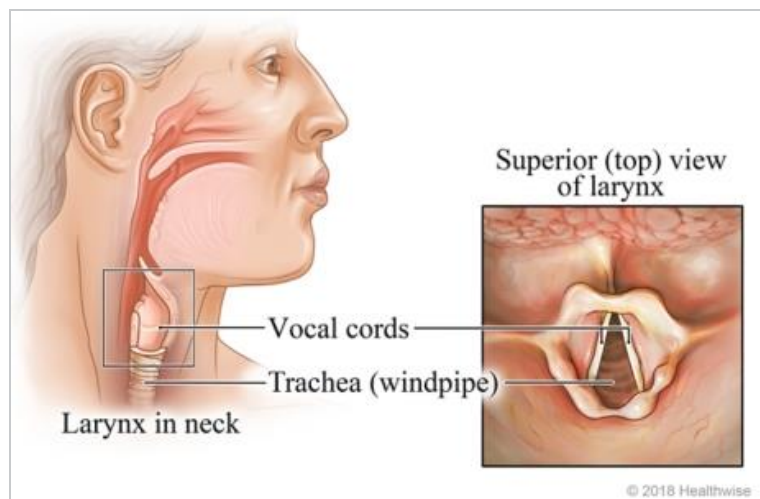
The larynx is the region within the body commonly associated with voice production. Its shape is commonly referred to as tube-like, as it is long, and narrow with a circular opening, refer to figure one. The structure allows for the movement of air and sound as it is aerodynamic (Seikel et al., 2019). There are multiple types of cartilage that provide the structure of the larynx. Three of these cartilages are paired, the cuneiform, arytenoid, and corniculate cartilage. While the remaining three cartilages, cricoid, thyroid, and epiglottis, are unpaired (Stemple et al., 2018). Cartilage is present within the larynx to protect the respiratory mechanisms while swallowing and respiration.

Located within the center of the larynx are the vocal folds, the source of speech sound production. Sometimes called the vocal cords, the vocal folds consist of two pieces of smooth muscle tissue that are located within the larynx. A mucous-like barrier exists on the vocal folds, known as the epithelium. (Stemple et al., 2018). The epithelium serves as a crucial barrier to protect the vocal folds from damage and bacteria. The vocal folds are categorized into the real

and false vocal folds based on their function and role in phonation. True vocal folds are heavily involved in phonation and vibrate however, the false vocal folds do not vibrate and do not play a significant role in voice production. These tissues are present at the top of the larynx and vibrate to create sound and voice. There are two movements of the vocal folds within phonation which are known as abduction and adduction which are controlled by the laryngeal muscles. The glottis is the space located between the vocal folds, which regulates the air flow through the larynx (Stemple et al., 2018).

The laryngeal muscles are divided into intrinsic and extrinsic muscles according to their placement. The intrinsic laryngeal muscles have two points of connection within the larynx while the extrinsic muscles have one point of connection within the larynx and another point connected outside of the larynx (Stemple et al., 2018). The extrinsic muscles allow for the elevation or depression of the larynx. The elevation of the larynx is essential for biological functions such as breathing, speaking, and swallowing. Intrinsic muscles of the larynx control the manipulation of the vocal folds. The vocal folds can be stretched or shortened, tensed, or relaxed, and adducted or abducted. Adduction is the closing of the vocal folds to prevent the passage of air, while abduction is the opening of the folds to allow air to pass through. During adduction, exhaled air is forced between the two vocal folds. Changes in pressure between the folds cause them to snap back together between small bursts of airflow. These movements create vibrations from which sound energy is created and can then be transformed into what we know as “voice” (Stemple et al., 2018).

**Figure 1: Anterior View of the Larynx**



*Note, From “Larynx (voice box)” in NorthShore University Health System Health Encyclopedia, 2022*

<https://www.northshore.org/healthresources/encyclopedia/encyclopedia.aspx?DocumentHwid=tp12324>

### *Articulators/Resonance System*

The articulators are the regions of the oral mechanism that shape the sounds that are produced by the vocal folds. Articulators are classified as mobile and immobile according to the manner in which they manipulate sound. Mobile articulators include the tongue, mandible, lips, and velum. The tongue controls articulation by its placement on the immobile articulators. The mandible, lips, and velum influence articulation by changing their positioning to produce a specific sound. For example, the raising or lowering of the velum or mandible and the rounding of the lips can change what speech sound is produced. Immobile articulators such as the alveolar ridge, teeth, and the hard palate, do not move to influence articulation. Although they are in fixed

positions, the immobile articulators allow for the process of articulation to occur on their surfaces (Seikel et al., 2019).

## **Steps in Voice Production**

### *Respiration*

Respiration is the first step in voice production as it allows the travel of air flow for the following steps to occur. The lungs are the basis of respiration and when the lungs function properly, they intake air from the surrounding environment and release all waste, leaving only oxygen in a process known as “gas exchange” (Seikel et al., 2019). After this process, oxygen is sent through the bloodstream to the rest of the body. Inspiration occurs when the diaphragm contracts to accommodate the amount of air filling the lungs, which increases the thoracic volume within the chest. During this step of respiration, the abdominal muscles are moved downward by the expansion of the lungs.

In terms of respiration for phonation, phonation occurs during expiration. Expiration is the release of air from the lungs that is which is influenced by the abdominal muscles which return to their relaxed positioning and the forces of gravity, pushing on the lungs. The acoustic result of speech production is pushed out during expiration (Seikel et al., 2019).

### *Phonation*

The second step in voice production is phonation, which refers to the vibration produced at the level of the larynx. There are two different types of phonemes, voiced which requires phonation and voiceless, which do not require phonation. Vibrations of the vocal folds create the

sound of voiced phonemes while voiceless phonemes do not require this step of vibration for their production (Seikel et al., 2019).

The vibrations that are associated with phonation are heavily based on the principles of acoustics. The relationship between acoustics and vibration is defined by Seikel et al. (2019) as “Vibration is governed by the interplay of elastic restoring forces, stiffness, and inertia” (Seikel et al., 2019, pg. 257). Vibrations of the vocal folds are best displayed in waves to represent the changes in air pressure from positive rates to negative (Seikel et al., 2019). The subglottal pressure changes according to how loud or soft a sound is. The forces of physics, specifically acoustics, allow for the continuous process of phonation during speech production.

Proper air flow is necessary for the vocal folds to vibrate. The vocal folds are a mobile region of the larynx; therefore, air pressure and flow can move the vocal folds, thus creating vibrations. The airflow produced during respiration pushes apart the vocal folds and once the pressure is reduced, the folds are returned to their closed positioning. This is where abduction and adduction take place during phonation (Seikel et al., 2019). The Myoelastic-Aerodynamic theory of voice production, as proposed by Van den Berg, is the explanation of how phonation occurs. The theory proposes that the reason that the vocal folds adduct and abduct during a vibratory cycle is due to the force of sub-glottal air pressure. When the vocal folds are in adducted positioning, the sub-glottal pressure will force the vocal folds open, into an abducted position. This causes air to be released over the vocal folds, which allows humans to produce what we know as our voice. After the air is released, subglottal pressure will decrease and draw the vocal folds back together. This process is constant and continues throughout the period that an individual is using their voice (Van den Berg, 1958).



Intensity, in terms of sound, refers to how loud a specific sound's auditory output is. The intensity of voice is determined by the subglottal pressure that is produced by the lungs. When subglottal pressure is high, vocal fold vibration amplitude will increase. This is because subglottal pressure is the force responsible for abducting the vocal folds. The amplitude of vocal fold vibration refers to how far the vocal folds separate during each cycle of vibration. Higher amplitude of vocal fold vibration will allow for a higher intensity (Stemple et al., 2018).

Pitch is the term used to describe how humans hear the fundamental frequency of voice. The fundamental frequency of a human voice is determined by the anatomical qualities of the vocal folds. These qualities include the length and the tension of the vocal folds. The cricothyroid muscle is responsible for the manipulation of the vocal folds which affects fundamental frequency. Shortening the vocal folds during voice production results in a lower pitch while lengthening of the vocal folds results in a higher pitch. Biological women tend to have shorter and less thick vocal folds than biological men. This results in biological women often having a higher-pitched voice than biological men. In order to increase the pitch of a voice, tension of the vocal folds must increase to allow for quicker vibrations. Vocal fold tension and vocal fold length have an important relationship because as length increases, the tension of the vocal folds also increases (Stemple et al., 2018).

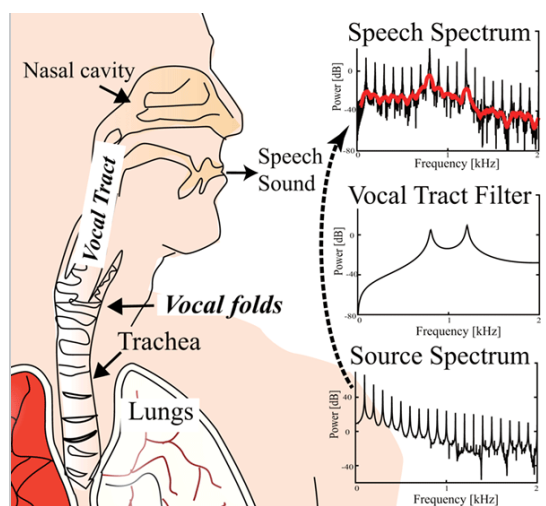
### *Resonance*

According to Stemple et al. (2018), "Resonance occurs when sound is reinforced, or prolonged as acoustic waveforms reflect off another structure" which provides the means for the vibrations to travel to areas of articulation (Stemple et al., 2018, pg. 22). There are several

cavities that play a role in the resonance process which are the oral, the pharynx, and nasal cavity, all found superior to the lungs and larynx. Structures within these cavities and their positions influence how the acoustic energy is changed.

The source-filter theory is used to describe and explain resonance in voice production. This theory provides the concept that the lungs are the source of energy. When the air produces travels upward, sound energy is produced at the level of the vocal folds during phonation and continues. The vocal tract then modifies or “filters” the end product, which is the acoustic sound of the voice, refer to figure two. The vocal tract consists of three cavities, the oral, pharyngeal, and nasal cavities. The resonant frequency of the cavity is responsible for the manipulation of the sounds, as it determines the pitch, and nasality of speech. Resonance is closely connected to the next step of articulation, these processes influence sound type, shape, and the auditory effects (Seikel et al., 2019).

**Figure 2: Source-Filter Theory**



Note, From “Source-Filter Theory of Speech” in *Oxford Research Encyclopedias*, 2021

<https://oxfordre.com/linguistics/view/10.1093/acrefore/9780199384655.001.0001/acrefore-9780199384655-e-894>

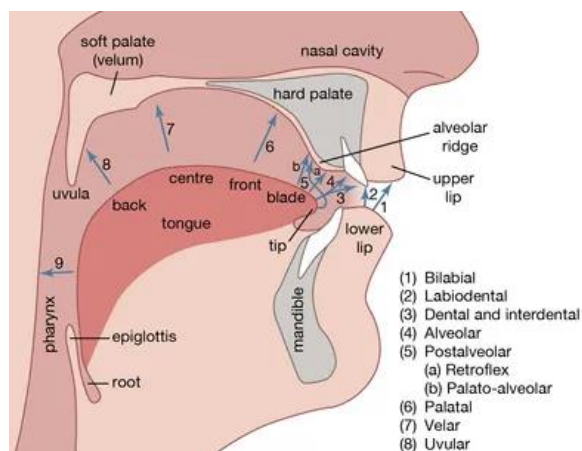
## *Articulation*

Articulation is the final step in voice production that molds the shape of the sound to produce phonemes. Articulation is heavily based on motor-control, therefore individuals who experience difficulty with motor planning and control may have difficulty with articulation. Errors in the step of articulation may result in the diagnosis of speech sound disorders such as developmental apraxia (ASHA, n.d.).

Articulation involves the coordinated movements of the articulators to produce speech sounds, or phonemes, which are needed for speech production. For most phonemes in the English language, the mobile articulator of the tongue is needed (Seikel et al., 2019). Without proper control over the tongue, many phonemes may be unintelligible or confused for a different phoneme.

A phoneme is grouped and labeled by various characteristics of how the phoneme is produced during the articulatory process. The groups of phonemes are stops, affricates, fricatives, glides, liquids, vowels, and nasals, which all are determined by how much airflow is used to produce each phoneme. These are known as the manner of articulation. Sounds can also be categorized by their place of articulation which include, bilabial, labiodental, dental, alveolar, palatal, velar and glottal, refer to figure three. The place of articulation is described by Carr (2012) as “points at which the flow of air can be modified” (Carr, 2012, pg. 2). This refers directly to which articulators are primarily used to produce each specific phoneme. Articulation is a complex and tedious step in voice production.

**Figure 3: Places of Articulation**



Note: From “Phonetics” in *Encyclopedia Britannica, Inc., n.d.*

<https://www.britannica.com/science/phonetics>

### What is a “Healthy Voice”?

The definition of a healthy voice can be viewed as a spectrum, dependent on the individual. A healthy voice may be described as one that has no disorder leading to easy speech production. There are various factors that contribute to healthy voicing including respiration, phonation, resonance, pitch, loudness, and rate (Seikel et al., 2019). Errors or malfunctions in any of these areas may lead to voice disorder or irregular voice production.

Irregular adduction of the vocal folds may lead to what is known as phonotrauma. Phonotrauma can cause serious injury to the vocal folds and affect voice production or lead to a voice disorder. Phonotrauma is typically preventable, as frequent causes are voice overuse and yelling. Speaking at a constant, low volume and prioritizing vocal health can help to prevent

phonotrauma (Stemple et al., 2018). This is known as vocal hygiene, a collection of behaviors contributing to healthy voice use. Utilizing voice hygiene promotes a decrease in usage of specific behaviors. Some examples include, decreasing yelling, decreasing throat clearing habits, and limiting long periods of speaking, if possible. Vocal hygiene can be used as preventative measure or as a part of voice therapy after the onset of disorder (Stemple et al., 2018).

## **Select Voice Disorders**

### *Spasmodic Dysphonia*

The clinical diagnosis of spasmodic dysphonia refers to a chronic voice disorder characterized by the spasming of the larynx, particularly the vocal folds. The auditory effect of spasmodic dysphonia is a voice characterized by shakiness and by having a strained quality (Eadie et al, 2017). There are three classifications of spasmodic dysphonia which are adductor spasmodic dysphonia, abductor spasmodic dysphonia and mixed. The terms “adductor” and “abductor” refer to the positioning of the vocal folds when the spasms occur (Ludlow, 2011). Due to the differences in positioning of the vocal folds, the several types of this disorder present differently. Adductor spasmodic dysphonia refers to the spasming of the larynx when the vocal folds are forced closed. Due to the rapid closing of the vocal folds, individuals diagnosed with adductor spasmodic dysphonia have a strained quality and difficulty with repetitive vowel production (Izdebski, 1992). Abductor spasmodic dysphonia presents differently as spasms occur and the vocal folds are put into an open position. This change in positioning during speech production results in speech with the presence of unintentional pauses (Hoffman et al., 2010). Mixed spasmodic dysphonia presents characteristics of both adductor and abductor spasmodic

dysphonia. All forms of spasmodic dysphonia in adults have an unknown etiology (Baylor et al., 2005). Therefore, little is known about how to prevent the onset of this disorder. Many attribute the disorder to vocal fold abnormalities. There is no direct cure for spasmodic dysphonia. However, research has shown that Botox injections, which is a strain of botulinum, alongside voice therapy sessions may alleviate some symptoms of the disorder. Botox is often used to prevent muscle contraction and therefore may reduce spasming in individuals with spasmodic dysphonia (Cannito et al., 2008).

### *Vocal Nodules and Polyps*

Vocal polyps and vocal nodules are two forms of voice disorders that occur on the vocal folds. Vocal nodules and polyps are typically associated with vocal abuse and misuse however, they may develop without. Vocal abuse may occur if an individual talks in an excess amount and at a high level of volume. Both disorders occur when the vocal folds are overused, and friction produces masses at the level of the vocal folds. A vocal polyp is a mass that can develop on the vocal folds and typically present as unilateral (Vasconcelos et al., 2019). Despite not having any malignant qualities, vocal polyps can create changes in an individual's voice, that may increase vocal production difficulty. The effects of vocal polyps can be characterized as hoarseness and dysphonia (Birchall et al., 2019). The key difference that exists between vocal polyps and vocal nodules is polyps present as unilateral while vocal nodules usually occur bilaterally. Vocal nodules share main characteristics with vocal polyps as both disorders exist in the form of lesions on the vocal folds and voice production is impaired by their presence. Both vocal nodules and vocal polyps are responsive to treatment. Surgical intervention or voice

therapy are often the methods used to treat both vocal polyps and nodules. These methods of treatment are often used in combination, with voice therapy following surgical interventions for the best results (Lee et al, 2017; Vasconcelos et al, 2019).

### *Vocal Paralysis*

Voice paralysis is a condition that causes an individual to lose their ability to control their vocal folds and laryngeal movements that are typically associated with speech production as well as swallowing. Injury to the area near the vocal folds causes this condition and its presence prevents movements of a single vocal fold or both vocal folds (Hsing-Won et al., 2020). Vocal fold paralysis is classified according to five factors including if the case is unilateral or bilateral, abductor or adductor, complete or incomplete, congenital or acquired and sensory or motor. (Menon et al, 2020). Paralysis of the larynx is usually a secondary condition meaning it is caused by another disease or pathology. The main causes being neurological and surgical with the main identifier is the strong presence of hoarseness in the voice (Shafkat et al., 2002). This diagnosis does not solely affect voice production as it can make breathing more difficult and cause problems during steps of swallowing and during breathing. Treatment of vocal paralysis varies dependent on the severity and its characterization. However, current research suggests that reparative surgeries, medical procedures, Botox injections, and voice therapy are the most effective (Li et al., 2017). A combination of these methods may be used or suggested by physicians and speech-language pathologists to achieve the best outcome for the individual.

### *Other Causes*

Traumatic events, disease, and medical procedures may affect the sound of an individual's voice or the method of production. Some examples might be laryngectomy, laryngeal cancer, tracheotomy, etc. Different neurodegenerative diseases such as Parkinson's disease can also impact voice quality. Voice changes may be one of the first physical signs of the disease in some individuals, Muscle function deterioration is one of the main effects of Parkinson's disease. The vocal folds are muscles and are therefore affected by the disease. Voice changes within Parkinson's disease are characterized by hoarseness, lack of intonation, and low volume during speech (Thijs et al., n.d.). Dysphonia, as mentioned prior, is also a common condition that is a secondary condition to the disease.

### **Perception by the Communication Partner**

#### *What is a Communication Partner?*

A communication partner is an individual involved in a communication process or event. Each day, individuals will typically be in communication with multiple communication partners for varied reasons including wants, needs, and social interactions. As humans, we look to build relationships to feel a sense of belonging. A way we do so is by communicating whether through speech, gestures, or signs. Communication allows humans to understand the emotions, thoughts, and opinions of others. Voice is described by Tiwari et al. (2012) as:

The voice is the very emblem of the speaker, indelibly woven into the fabric of speech. In this sense, each of our utterances of spoken language carries not only its own message but also, through accent, tone of voice and habitual voice quality it is at the same time an audible declaration of our membership of particular social



regional groups, of our individual physical and psychological identity, and of our momentary mood (Tiwari et al., 2012, p.1).

This explains the complex and strong relationship between communication, voice, and the individual. Voice allows humans to learn some personal history based on accent and offers insight into what we may be thinking or feeling. A communication partner can draw conclusions based on tone, quality, pitch, intensity, or by the words within in the communicative act.

### *Perception of a Communication Partner*

During the process of verbal communication between at least two partners, each individual involved may develop either a positive or negative perception of the other participant. The perception of a communication partner is influenced by many factors, including voice quality. In a study conducted by researchers at Florida Atlantic University (FAU), voice recordings of individuals who have differing speech, language, articulation, fluency, and voice disorders were played to participants. The participants were asked to make judgments about each of the voices being played based on factors including reliability, intelligence, emotional stability, decisiveness, self-esteem, ambition employability, etc. The study found that the recording of the individual with a voice disorder scored lower on self-esteem, ambition, employability, and overall intelligence than the recording of the individual who had no presence of disorder (Allard et al, 2007). Thus, showing that communication partners may unintentionally develop negative beliefs based solely on voice quality. This study may explain the social effects that those diagnosed with a voice disorder may face during communication processes. Does a voice disorder impact how older adults perceive an individual? The Voice Terminology Study aims to

understand what factors regarding voice contribute to positive and negative perceptions of voice and personality.

## **Chapter 3 : Methods**

### **Purpose**

This voice terminology study utilized the descriptions given by older adults to describe various vocal qualities to better understand what factors contribute to the descriptive words chosen. This study has been conducted with the goal to aid clinical speech-language pathologists to better understand which factors may affect the descriptive terms and personality traits that are chosen to describe a wide variety of voices.

### **Participants**

To complete the aims of this study, healthy adults were recruited to participate in this study. To participate in this study, individuals needed to be 40 years or older, United States residents, and have hearing and language proficiency in English enough to complete this study. The goal number of participants for the study was 50 adults. This study was approved by the Pennsylvania State University Institutional Review Board.

### **Procedure**

Willing participants who met the inclusion criteria and agreed to be a part of the study identified a meeting time with the primary researcher. A copy of the written consent form was

provided by email prior to the appointment to ensure the participant had adequate time to review.

Then the consent form was reviewed with the primary researcher at the appointment.

At the start of the study, participants answered demographic questions as seen in Appendix A. Participants were asked to provide information on their level of education, knowledge regarding voice disorders, age, gender, and occupation. These questions were used later to provide insight on the relationship between these demographic factors and the individuals perception of the voices.

Each participant listened to 10 different voice audio recordings. Each voice audio sample is from the Patrick R. Walden Perceptual Voice Qualities Database (PVQD). The stimuli included voices that differed in terms of gender, age, presence and impact of disorder, and overall voice quality. Each voices quality was rated by the use of CAPE V form as seen in Appendix B. The recordings included individuals with different vocal disorders. The age of the individuals in the voice recordings ranged from 21-88 years of age. Each voice recording was played for the participant twice. For each voice sample, the participant was asked a series of questions to describe the voice they heard. Appendix B displays the questions asked to participants following the recordings. Participants were asked to identify the age and gender of each voice. Then they were asked to provide three adjectives to describe the voice. Finally, participants were asked to provide three personality traits they would associate with this voice. The questions asked remained the same for each participant and each recording. The study took approximately 20-30 minutes to complete.

**Table 1: Voice Sample Audio Clips**

<b>Sample Number</b>	<b>Description for Study</b>	<b>Sex</b>	<b>Age</b>	<b>Diagnosis</b>	<b>CAPE-V Score</b>
<b>1</b>	Young Female	F	21	N/A	19.333
<b>2</b>	Young Male	M	34	N/A	15.500
<b>3</b>	Aging Female	F	88	N/A	65.833
<b>4</b>	Aging Male	M	77	N/A	18.833
<b>5</b>	Mild Female	F	55	Vocal Fold Lesions	30.833
<b>6</b>	Mild Male	M	27	Muscle Tension Dysphonia (MTD)	14.667
<b>7</b>	Moderate Female	F	64	Muscle Tension Dysphonia (MTD)	61.167
<b>8</b>	Moderate Male	M	72	Lesions	60.667
<b>9</b>	Severe Female	F	71	Reinke's Edema	98.667
<b>10</b>	Severe Male	M	81	Lesions	98.500

*Note.* Reprinted from “Perceptual Variations in Voice Descriptions for College-Aged Students”, by Buterbaugh, J, 2022. 20.

## Chapter 4 : Results

### Participants

This study collected data from 10 individuals. The ages of the participants ranged from 51 to 76 years old. All but one of the participants had received some form of a college degree, with the highest level being a master's degree. Occupations of the participants varied, with one individual identifying as retired, see table 1 for a list of participants' occupations. One participant knew someone who has had voice therapy while two others knew individuals who had speech-language therapy.

**Table 2: Participant Demographics**

<b>Participant Number</b>	<b>Age</b>	<b>Gender</b>	<b>Years of education</b>	<b>Occupation</b>
1	65	Female	15 years	English Language
2	67	Female	15 years	Rehabilitation Nurse
3	76	Female	12 years	Retired
4	51	Male	15 years	Financial Services
5	52	Female	17 years	Social Worker
6	55	Female	15 years	Accountant
7	54	Female	17 years	Teacher
8	50	Male	15 years	Sales
9	52	Female	15 years	Healthcare IT Consultant
10	53	Female	15 years	Freelance Marketing

*Sample 1: Young Female, Normal Voice*

Sample 1 is a recording of a 21-year-old female whose voice contains no presence of a vocal disorder. Six out of the 10 participants responded with the correct age group of 20-30. One participant said the voice was 30-40 years old, two said the voice was 40-50 years old and one participant said the voice was 80+ years old. All ten of the participants accurately said stated that the voice was a female. Eight participants correctly stated that the voice is normal and the remaining two chose minimally impaired. When describing the voice in sample 1, the most common words used were clear, monotone, pleasant and strong which were each used by two different participants. When describing sample 1 personality traits, the most common words were youthful, friendly, and fun. Figure 4 is a word cloud that depicts all the words used to describe the speaker's voice. Figure 5 is a word cloud that depicts the words used to describe the speaker's personality.

**Figure 4: Sample 1, Voice Descriptors**

*www.wordart.com*



### Figure 5: Sample 1, Personality Traits

*www.wordart.com*



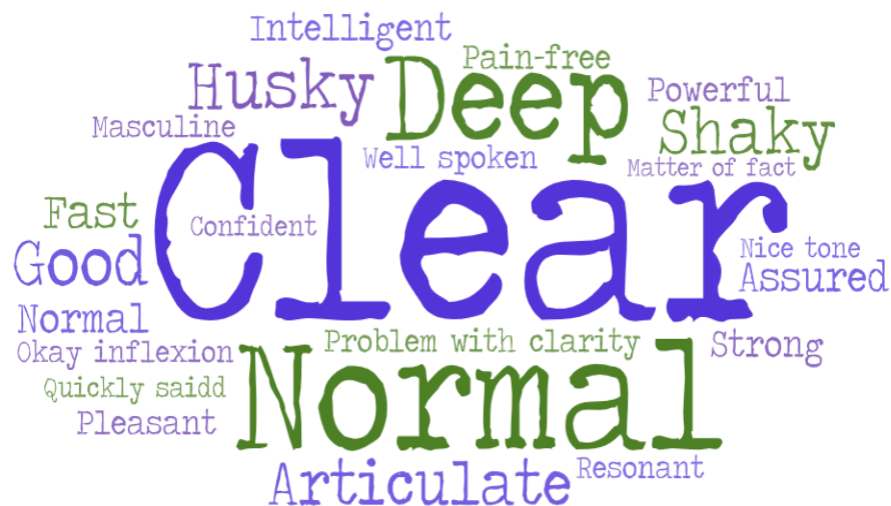
### *Sample 2: Young Male, Normal Voice*

Sample 2 is a 34-year-old male with a normal voice and no voice disorder. Six out of the ten participants correctly stated that the voice was between 30-40 years old. Two participants stated the voice was 20-30 years old, one stated the voice was 40-50 years old and the remaining participant stated the voice was 80+ years old. All ten of the participants said the voice was male. Seven participants accurately said the voice was normal and the remaining three stated the voice was minimally impaired. Clear, deep, and normal were the descriptors used most frequently by the participants to describe the voice in sample 2. Friendly, educated, and well-spoken were most frequently used to describe his personality traits. Figure 6 is a word cloud that depicts all the words used to describe the speaker's voice. Figure 7 is a word cloud that depicts the words used to describe the speaker's personality.

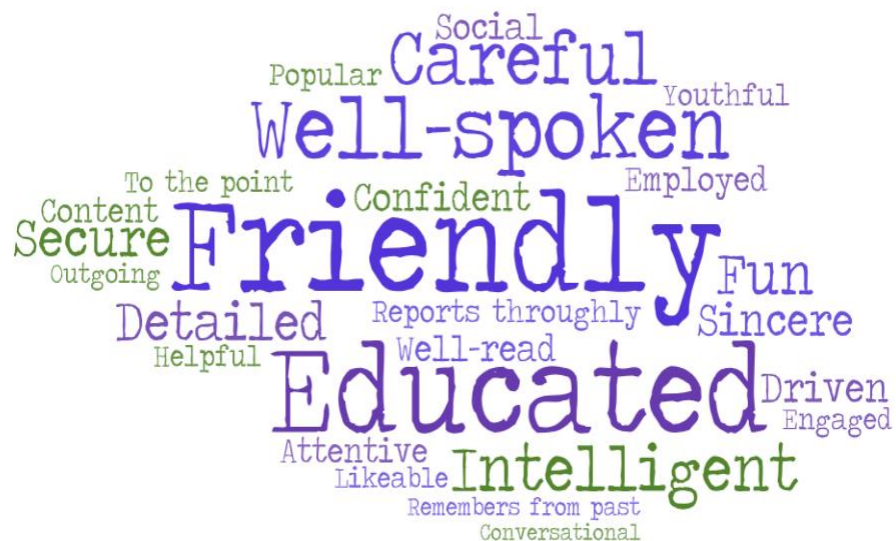


**Figure 6: Sample 2, Voice Descriptors**

[www.wordart.com](http://www.wordart.com)

**Figure 7: Sample 2, Personality Traits**

[www.wordart.com](http://www.wordart.com)

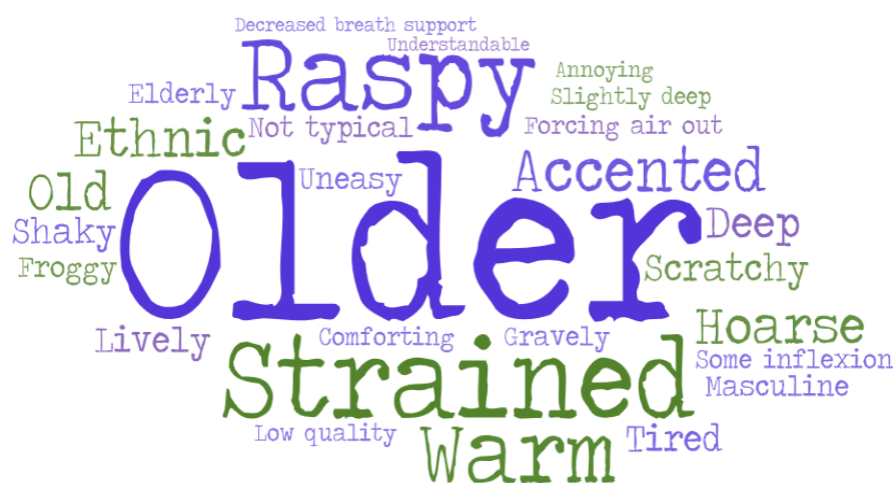


*Sample 3: Older Female, Normal Voice*

Sample 3 is an 88-year-old female who has a normal voice and does not have a voice disorder. Two participants correctly estimated that the individual was 80+ years old. Four participants believed the individual was 60-70 and three participants believed the voice was 70-80 and one said the voice was 40-50 years old. All ten participants correctly said the voice was female. Two participants correctly said the individual has a normal voice. Five participants said the voice was minimally impaired and two participants said the voice was moderately impaired. One participant said the voice was moderately impaired. The three most common words used to describe the voice of sample 3 were older, raspy, and strained. The three most common words used by participants to describe the sample's personality traits were friendly, caring, and kind. Figure 8 is a word cloud that depicts all the words used to describe the speaker's voice. Figure 9 is a word cloud which displays the words used to describe the speaker's personality.

**Figure 8: Sample 3, Voice Descriptors**

[www.wordart.com](http://www.wordart.com)



### Figure 9: Sample 3, Personality Traits

*www.wordart.com*



### *Sample 4: Older Male, Normal Voice*

Sample 4 is a 77-year-old male with a normal voice and no voice disorder. Two participants accurately identified the individuals' age as being between 70-80. One participant said the individual was 40-50 years old and two participants said the individual was 50-60 years old. Four participants said the voice was 60-70 years old and one participant said the individual was 80+ years old. Eight of the participants correctly stated that the individual was a male. One participant said that the voice was more male than female and the remaining participant said the voice was more female than male. Seven of the ten participants correctly stated the voice was normal. Two of the participants said the voice was minimally impaired and one participant said the voice was mildly impaired. The most common voice descriptors used by participants were clear and strong. The most used personality trait for sample 4 was friendly. Figure 10 is a word cloud that depicts all the words used to describe the speaker's voice. Figure 11 is a word cloud which displays the words used to describe the speaker's personality.

**Figure 10: Sample 4, Voice Descriptors**

*www.wordart.com*



**Figure 11: Sample 4, Personality Traits**

*www.wordart.com*

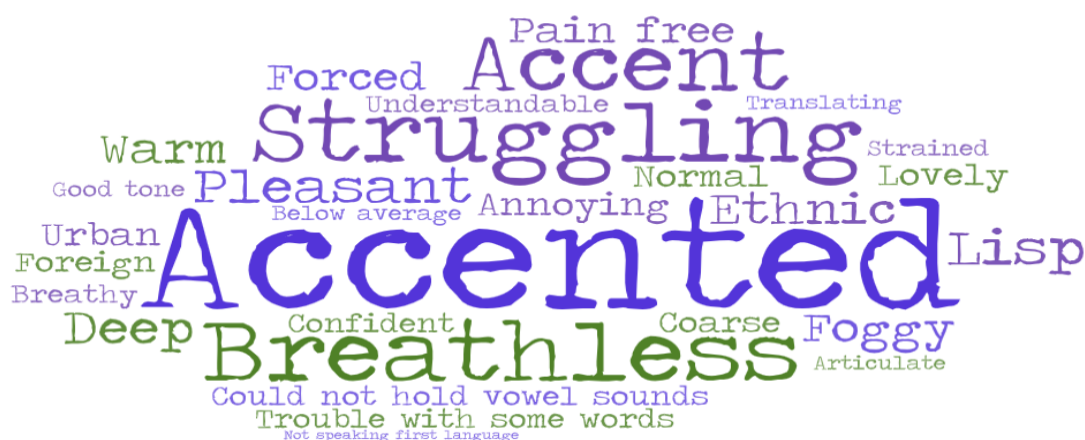


*Sample 5: Mid-Aged Female, Mild Voice Disorder*

Sample 5 is a 55-year-old female who has mild voice disorder and vocal fold lesions. One participant correctly estimated the age of 50-60. Four participants stated the age of the voice was 40-50 and five of the participants stated the age was 30-40. All ten participants correctly said the voice was female. Three participants stated the voice was normal, five participants said the voice was minimally impaired and two participants said the voice was moderately impaired. The most used voice descriptor was accented, and the most used personality trait was outgoing. Figure 12 is a word cloud that depicts all the words used to describe the speaker's voice. Figure 13 is a word cloud which displays the words used to describe the speaker's personality.

**Figure 12: Sample 5, Voice Descriptors**

*www.wordart.com*



### Figure 13: Sample 5, Personality Traits

*www.wordart.com*



### *Sample 6: Young Male, Mild Voice Disorder*

Sample 6 is a 27-year-old male who has a mild voice disorder and was diagnosed with Muscle Tension Dysphonia (MTD). Four participants correctly estimated the voice to be between 20-30 years old. One participant said the voice was 30-40, two participants said the voice was between 40-50 years old and two participants said the voice was between 50-60 years old. One participant said the voice belonged to an individual who is 80+. Four of the participants indicated the voice was male and three participants said the voice was female. Two participants stated the voice was more female than male and one participant said the voice was more male than female. Seven participants stated the voice was normal. One participant said the voice was minimally impaired and one participant stated the voice was mildly impaired. The remaining participant said the voice was moderately impaired. The most used words to describe this individual's voice were monotone, clear, and normal. The most used words to describe this individual's personality were boring and average. Figure 14 is a word cloud that depicts all the

words used to describe the speaker's voice. Figure 15 is a word cloud which displays the words used to describe the speaker's personality.

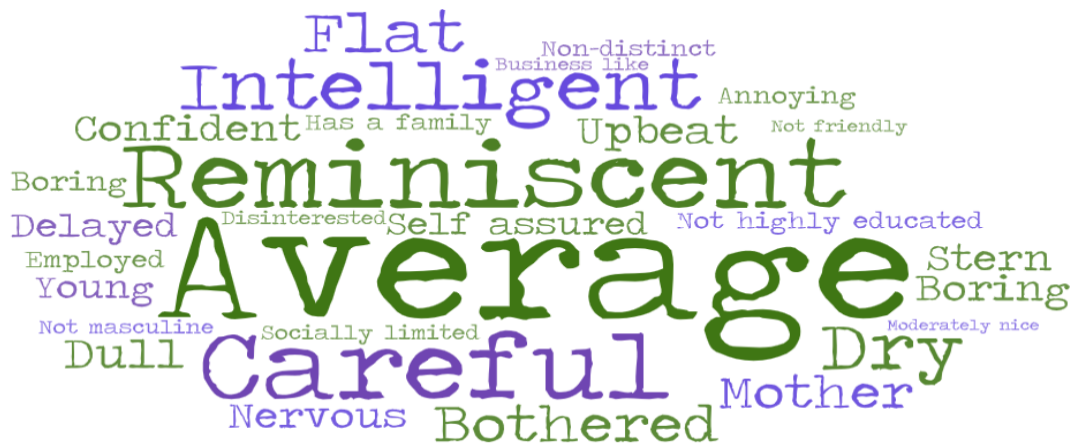
**Figure 14: Sample 6, Voice Descriptors**

*www.wordart.com*



**Figure 15: Sample 6, Personality Traits**

*www.wordart.com*

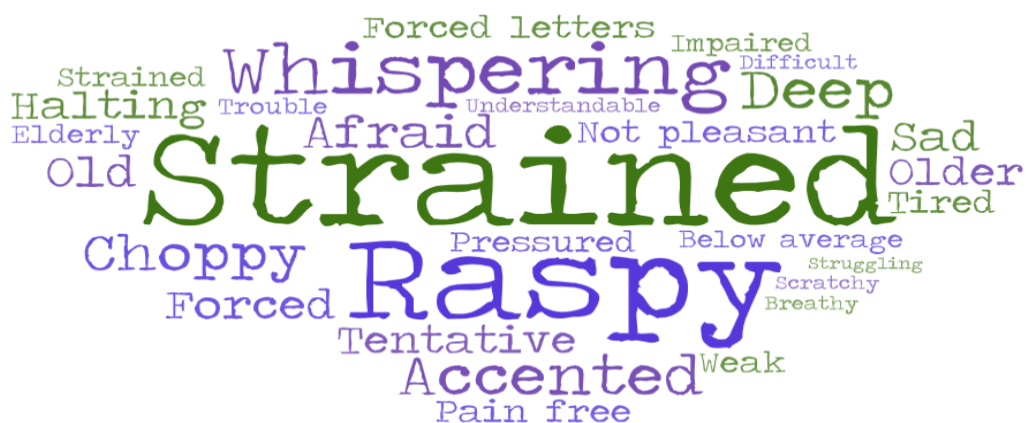


*Sample 7: Older Female, Moderate Voice Disorder*

Sample 7 is a 64-year-old female who has a moderate voice disorder and a diagnosis of Muscle Tension Dysphonia (MTD). Three participants accurately estimated the individuals' age to be between 60-70. One participant said the voice was 40-50 years old and four participants said the voice was 50-60 years old. Two participants stated the voice was 70-80 years old. Nine of the participants correctly stated the voice was female and one participant stated the voice was more female than male. Four participants accurately stated that the individual's voice was moderately impaired. Two participants expressed the voice was minimally impaired and three participants said it was mildly impaired. One participant said the voice was severely impaired. The most used term to describe the individual's voice was strained. In terms of personality traits, the most frequently used words used were friendly and difficult. Figure 16 is a word cloud that depicts all the words used to describe the speaker's voice. Figure 17 is a word cloud which displays the words used to describe the speaker's personality.

**Figure 16: Sample 7, Voice Descriptors**

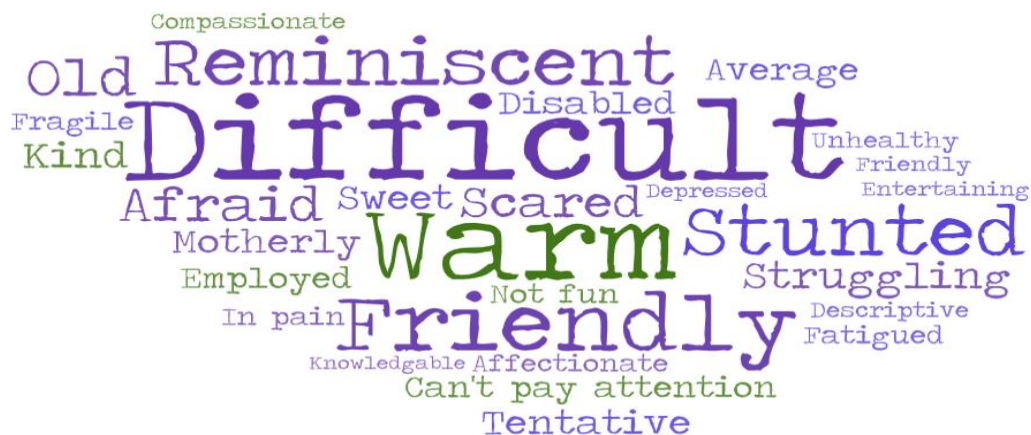
*www.wordart.com*





### Figure 17: Sample 7, Personality Traits

www.wordart.com



### Sample 8: Older Male, Moderate Voice Disorder

Sample 8 is a 72-year-old male who has a moderate voice disorder and has been diagnosed with lesions. Three participants correctly estimated the individual's age to be between 70-80. Two participants stated the voice was 60-70 years old and five participants said the voice was 80+ years old. Eight of the participants identified the individual as being male. One participant stated the voice was neutral in terms of sex and one participant stated the voice was more male than female. Four participants were able to identify the individual's voice as being moderately impaired. One participant stated the voice was normal, two participants stated the voice was minimally impaired, and one participant stated the voice was mildly impaired. The final two participants estimated the voice was severely impaired. The most used terms for voice descriptors provided by the participants were hoarse, strained, gravelly and old. Multiple participants describe this individual's personality as warm. Figure 18 is a word cloud that depicts

all the words used to describe the speaker's voice. Figure 19 is a word cloud which displays the words used to describe the speaker's personality.

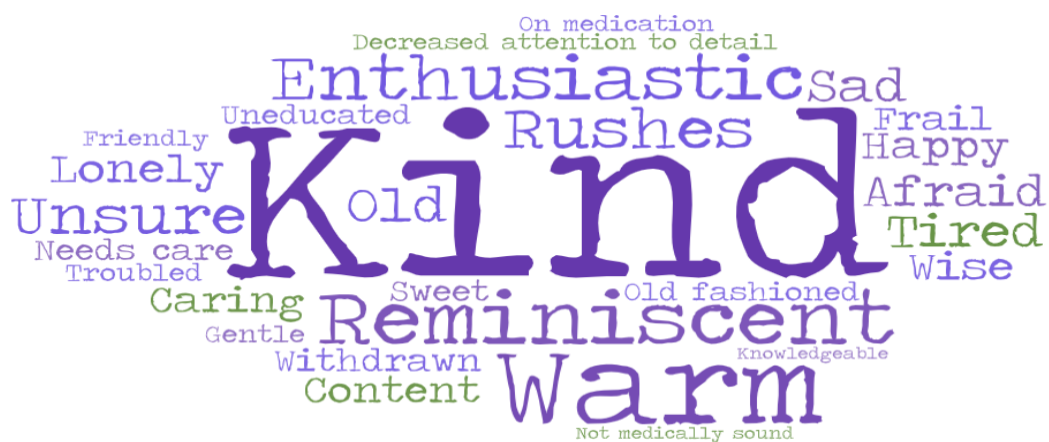
**Figure 18: Sample 8, Voice Descriptors**

*www.wordart.com*



**Figure 19: Sample 8, Personality Traits**

*www.wordart.com*



*Sample 9: Older Female, Severe Voice Disorder*

Three participants were unable to answer questions regarding sample 9 due to audio playback issues. Sample 9 is a 71-year-old female diagnosed with a severe voice disorder and has been diagnosed with Reinke's Edema. Two participants accurately identified the individual as being between 70-80 years old. One participant said the individual was 20-30, two participants said the voice was 40-50 years old, one participant said the voice was 50-60 and the remaining participant said the voice was 80+ years old. Four participants correctly identified the individual being female. Two participants said the voice was more female than male and one participant said the voice was more male than female. Three participants stated the voice was severely impaired. One participant stated the voice was normal, one participant said the voice was minimally impaired and the remaining two participants said the voice was moderately impaired. The word strained was most often used to describe the individual's voice. Terms used to describe the individual's personality varied. Figure 20 is a word cloud that depicts all the words used to describe the speaker's voice. Figure 21 is a word cloud which displays the words used to describe the speaker's personality.

**Figure 20: Sample 9, Voice Descriptors**

[www.wordart.com](http://www.wordart.com)



**Figure 21: Sample 9, Personality Traits**

[www.wordart.com](http://www.wordart.com)

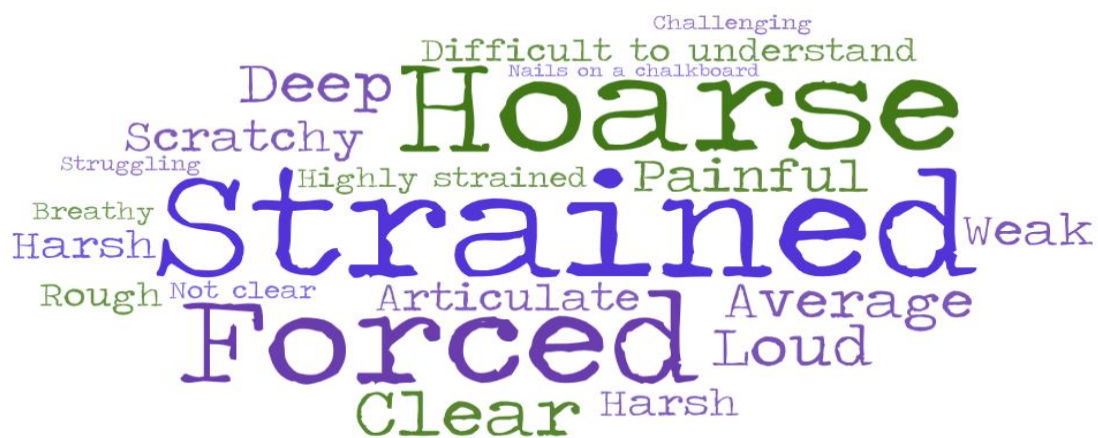


*Sample 10: Older Male, Severe Voice Disorder*

Sample 10 is an 81-year-old male who has a severe voice disorder and has been diagnosed with lesions. Three participants correctly identified the individual as being 80+ years old. One participant described the individual as being 30-40 years old and one participant described the individual as being 50-60 years old. Four participants described the individual as being 60-70 years old and one participant said the individual was 70-80 years old. Five participants accurately said the voice was male while four participants said the voice was more male than female. One participant described the voice as more female than male. The individual's voice was described as normal by one participant, minimally impaired by two participants and moderately impaired by three participants. The remaining four participants described the voice and severely impaired. Strained, harsh and hoarse were used the most to describe the individual in sample 10's voice. Friendly and kind were most frequently used to describe this individual's personality. Figure 22 is a word cloud that depicts all the words used to describe the speaker's voice. Figure 23 is a word cloud which displays the words used to describe the speaker's personality.

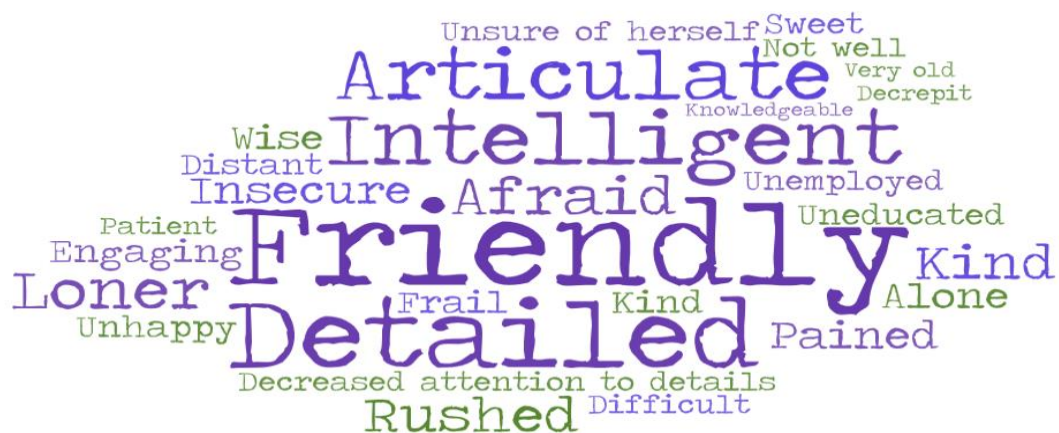
**Figure 22: Sample 10, Voice Descriptors**

*www.wordart.com*



**Figure 23: Sample 10, Personality Traits**

*www.wordart.com*



**Table 3: Voice Recording Descriptors**

<b>Voice Sample</b>	<b>Description</b>	<b>Sex</b>	<b>Age</b>	<b>Repeated Voice Descriptors</b>	<b>Repeated Personality Traits</b>
1	Young Female	F	21	Clear Monotone Pleasant	Youthful Friendly Fun
2	Young Male	M	34	Clear Deep Normal	Friendly Educated Well-spoken
3	Aging Female	F	88	Older Raspy Strained	Friendly Caring Kind
4	Aging Male	M	77	Clear Strong	Friendly
5	Mild Female	F	55	Accented	Outgoing
6	Mild Male	M	27	Monotone Clear Normal	Boring Average
7	Moderate Female	F	64	Strained	Friendly Difficult
8	Moderate Male	M	72	Strained Gravely Old	Warm
9	Severe Female	F	71	Strained	N/A
10	Severe Male	M	81	Strained Harsh Hoarse	Friendly Kind

## Chapter 5 : Discussion

The focus of this study was improving our understanding of what factors impact the perception of voice by older adults. Each participant answered demographic questions regarding sex and age and listened to ten voice recordings. Key trends were found once all data had been collected. Older voice samples were more likely to be interpreted negatively as opposed to younger voices. It is of note that multiple participants expressed difficulty in finding appropriate voice descriptors. As the level of severity increased, more negatively associated words were used to describe the individual's personality. More severe cases of voice disorders were given more negatively attributed descriptions. Results from older participants in this study were compared with those of previously collected college-aged students who completed the same study protocol. Various similarities within terminology and perception by older and college-aged participants to describe voice quality and personality traits were found.

### *Perceptions based on age:*

The ages of the voices in the sample recordings are between 21 and 88 years old. Participants in this study used more positive terms that correlated to sociability when describing personality traits for younger adult voices. The 21-year-old individual's personality was most commonly described as youthful, friendly, and fun. All three of which have a positive association to them. The oldest individual at 88 years old is featured in sample 3. The main descriptors of sample 3's personality traits were friendly, caring, and kind which also have a



positive connotation. Older and younger voices with no disorder received mainly positive personality attributions.

The main difference between the descriptions of younger and older individuals in this study is shown in the voice descriptions. For sample 3, an 88-year-old female, the most common voice descriptors were older, strained, and raspy. These terms have a more negative connotation and may be attributed to older age as the vocal folds may weaken with age and use (*Aging Voice*, n.d). As a result, the voice produced will sound weaker and less clear. Breath support for speech production may also decrease with age (Graetzer et al., 2016). Breath support plays a large role in how a voice sounds in terms of strength. Sample 1, a 21-year-old female, commonly received terms such as clear, monotone, pleasant, and strong. The words clear and strong may be attributed to the perceived youth of the individual due to younger and stronger vocal folds. Participants gave both the youngest and oldest voices with no voice disorder positive personality attributions. Participants gave voice descriptors that were more negative for older voices and more positive for younger voices.

#### *Perceptions based on severity:*

The recordings utilized in this study featured voices with no presence of disorder and voices with a voice disorder ranging from mild to severe. Severity impacted the way in which older adults perceived the sex of the individual. Participants were less likely to be certain of the sex of the individual as the level of severity increased. More participants opted for “more male than female” or “more female than male” in voice samples that were moderately and severely impaired than in samples with no impairment or mild impairment. This may be due to the effects

voice disorders have on the vocal folds. Voice disorders can affect pitch. Length and the natural thickness of the vocal folds also can affect the pitch of a voice (Zhang, 2022). Men biologically have longer, thicker vocal folds which result in a lower pitch, and to listeners, the voice sounds deeper. Women biologically tend to have shorter, thinner vocal folds resulting in a higher-pitched voice. Smaller vocal folds have the ability to vibrate faster which results in this higher pitch (Titze, 1987). Voice disorders affect the use of the larynx. Therefore, voice disorders can change an individual's ability to control pitch, which may result in a voice sounding higher or lower (Wang et al., 2022). The change in pitch due to a voice disorder may affect the perceived biological sex of the individual by participants. The effects of voice disorders on the larynx may account for the increased use of “more male than female” and “more female than male” for voices with a disorder present.

Participants noted quality change depending on the level of severity. Samples 7, 8, 9 and 10 all had their voices described as “strained”. Samples 7 and 8 have a moderate voice disorder and samples 9 and 10 have severe voice disorders. The majority of the participants identified each of these samples as having some form of impairment. In contrast, Participants often used words such as clear and strong when describing samples with no voice disorder. Sample 3 was an older female with no voice disorder. Participants used similar terminology to samples 7, 8, 9 and 10 for this voice. Sample 3’s most common voice descriptors were older, raspy, and strained. This may show the relationship between disorder and age and how they influence the perception of voices. Older voices are more likely to sound strained due to changes within the larynx and its muscles. The vocal folds become weaker and stiffer resulting in changes in how the voice sounds. These changes due to age are known as presbyphonia. Presbyphonia is associated with a voice that sounds “hoarse” (Galluzzi & Garavello, 2018). Individuals with voice disorders may

also present with a hoarse quality of voice. Therefore, perceptual characteristics of older voices and disordered voices may account for the overlap seen in the results from sample 3.

There was not a change in the terms used to describe the individual's personality dependent on their severity. Participants used the term 'friendly' for many of the samples, regardless of the level of severity of the voice disorder. However, it is of note that for sample 7, an older female with a moderate voice disorder, the word difficult was used to describe the personality several times. Participants more frequently discussed the level of education of samples with a disorder present, Participants described the level of education in both positive and negative ways. Sample 6 is a young male with a mild voice disorder. Sample 6 was described as delayed, highly educated, and intelligent, by different participants. Sample 8, who has a moderate voice disorder, was described as uneducated by one participant but knowledgeable and wise by others. Participants more frequently discussed health characteristics for the individuals with severe voice disorders. Sample 7's personality was described as disabled, fatigued, unhealthy, fragile, and depressed. Sample 8 received personality traits such as frail, needs care, not medically sound, and on medication. Sample 9 received traits such as sickly and in pain and sample 10 received germs such as decrepit, pained, and frail. Participants described voices with more severe voice disorders with negative terms related to health.

*Comparison to previously-collected younger adult perspectives:*

Previously, this protocol was completed with college-aged individuals (Butterbaugh, 2022). The results of the prior study can be used as a basis for general comparison between younger adult and older adult perspectives. Both college-aged students and older adults tended to

describe younger voices with positive terms and terms that signify sociability. Samples 1 and 2 were young voices with no voice disorder. Older adults commonly described both samples 1 and 2 as “friendly”. Younger adults used “outgoing” as a common term to describe the same samples. Both these terms indicate a high level of perceived sociability and are highly positive, thus indicating a similarity between the results of both studies regarding younger voices with no disorder. College-aged adults and older adults both had high levels of accuracy at correctly identifying the sex of the voice recording. Thirteen out of fifteen college-aged students accurately said that sample 5 was a female voice. All ten older adult participants were correct in guessing the sex of sample 5. Similarly, both college-aged and older adults opted to use “more male than female” and “more female than male” more often as severity increased. Another similarity was found in regard to severity. Participants used more words with a negative connotation when describing the samples with higher severity. For example, sample 9 features an individual with a severe voice disorder. College-aged adults most frequently used the personality descriptors shy, quiet, and weak. In comparison, older adults used terminology that varied, but was majority negative. Older adults used some words for sample 9 such as sickly, quiet, and reserved. College-aged students and older adults presented multiple similarities regarding terminology, See table 4 for a full list of the results from the prior study on college-aged adults (Butterbaugh, 2022).

### *Limitations & Future Directions*

The limitations of this study are primarily due to the sample size of 10 participants. This study was conducted over a period of five months which played a role in the small sample size. All but one of the participants were in their fifties, with the remaining participant being in their

seventies. Therefore, most of the participants come from the same generation which may have played a role in their answer choices and perceptions. Eight participants were female, and two participants were male. Having a majority female participant group may have affected overall results.

In the future, this study should be conducted with a wider group of participants and the sample size should be significantly greater than in this study. With a greater number of participants, more trends would be able to be identified. This study protocol should be conducted with greater number of participants over the age of 60 as to accurately represent the population over 60 years old. This study protocol should also be done with younger children, under the age of 18. It would be important to see how younger children perceive different voices in order to provide the grounds for further comparison between age groups. In future studies, it would be important to have participants explain their reasoning for selecting terminology related to voice descriptions as well as personality traits. Explanations would allow for further understanding of older adult perceptions of differing voices.

### *Conclusion*

Voice is the way humans express themselves to others and can impact the message being given and personal perceptions. Based on the results of this Voice Terminology Study, voice disorders impact the way individuals are perceived by older adults. Both severity of a voice disorder and the speaker's age negatively influenced participant judgments regarding voice and personality. This study protocol conducted with college-aged students produced similar results when compared to older-adults. Speech-language pathologists can use information from this

study to better understand concerns and perceptions of clients regarding their own voice.

Understanding perceptual implications of a voice disorder facilitates client counseling and future clinical treatment.

**Table 4 : Voice Sample Descriptors (College-Aged Adults)**

<b>Sample Number</b>	<b>Description for Study</b>	<b>Sex</b>	<b>Age</b>	<b>Top 3 Voice Adjectives</b>	<b>Top 3 Personality Traits</b>
<b>1</b>	Young Female	F	21	Loud Clear High-Pitched	Outgoing Young Energetic
<b>2</b>	Young Male	M	34	Clear Strong Loud	Confident Enthusiastic Relaxed
<b>3</b>	Aging Female	F	88	Raspy Quiet Shaky	Sad Old Kind
<b>4</b>	Aging Male	M	77	Clear Shaky Strong	Kind Confident Sociable
<b>5</b>	Mild Female	F	55	Smooth Accented Slow	Caring Quiet Shy
<b>6</b>	Mild Male	M	27	Monotone Clear High	Bored Impatient Nervous
<b>7</b>	Moderate Female	F	64	Strained Breathy Slow	Tired Nervous Calm
<b>8</b>	Moderate Male	M	72	Raspy Quiet Strained	Wise Kind Sad
<b>9</b>	Severe Female	F	71	Quiet Breathy Whispery	Shy Quiet Weak
<b>10</b>	Severe Male	M	81	Raspy Quiet Weak	Old Shy Wise

*Note.* Reprinted from “Perceptual Variations in Voice Descriptions for College-Aged Students”, by Buterbaugh, J, 2022. 20.

**Appendix A: Participant Demographics**

Participant Number:

Age	
Sex	
Years of Education	
Occupation	
Have you or someone you known had a voice problem?	
Have you or someone you known had voice therapy?	



## Appendix B: CAPE-V FORM

### Consensus Auditory-Perceptual Evaluation of Voice (CAPE-V)

Name: \_\_\_\_\_

Date: \_\_\_\_\_

The following parameters of voice quality will be rated upon completion of the following tasks:

1. Sustained vowels, /a/ and /i/ for 3-5 seconds duration each.
2. Sentence production:
 

a. The blue spot is on the key again.	d. We eat eggs every Easter.
b. How hard did he hit him?	e. My mama makes lemon muffins.
c. We were away a year ago.	f. Peter will keep at the peak.
3. Spontaneous speech in response to: "Tell me about your voice problem." or "Tell me how your voice is functioning."

**Legend:** C = Consistent I = Intermittent  
 MI = Mildly Deviant  
 MO = Moderately Deviant  
 SE = Severely Deviant

			<u>SCORE</u>
Overall Severity _____	MI	MO	C I _____/100
Roughness _____	MI	MO	C I _____/100
Breathiness _____	MI	MO	C I _____/100
Strain _____	MI	MO	C I _____/100
Pitch (Indicate the nature of the abnormality): _____	MI	MO	C I _____/100
Loudness (Indicate the nature of the abnormality): _____	MI	MO	C I _____/100
_____	MI	MO	C I _____/100
_____	MI	MO	C I _____/100

COMMENTS ABOUT RESONANCE:    NORMAL    OTHER (Provide description): \_\_\_\_\_

ADDITIONAL FEATURES (for example, diplophonia, fry, falsetto, asthenia, aphonia, pitch instability, tremor, wet/gurgly, or other relevant terms):

Clinician: \_\_\_\_\_

## BIBLIOGRAPHY

- Ahmad, S., Muzamil, A., & Lateef, M. (2002). A study of incidence and etiopathology of vocal fold paralysis. *Indian Journal of Otolaryngology and Head & Neck Surgery*, 54(4), 294-296. <https://doi.org/10.1007/BF02993746>
- Allard, E. R., & Williams, D. F. (2008). Listener's perception of speech language disorders. *Journal of Communication Disorders*, 41(2), 108-123. <https://doi.org/10.1016/j.jcomdis.2007.05.002>
- American Speech-Language-Hearing Association. (n.d.). *Spasmodic Dysphonia* <https://www.asha.org/public/speech/disorders/spasmodic-dysphonia/>
- American Speech-Language-Hearing Association. (n.d.) *Speech Sound Disorders – Articulation and Phonology*, <https://www.asha.org/practice-portal/clinical-topics/articulation-and-phonology/>
- Baylor, C. R., Yorkston, K. M., & Eadie, T. L. (2005). The consequences of spasmodic dysphonia on communication-related quality of life: a qualitative study of the insider's experience. *Journal of Communication Disorders*, 38(5), 395-419. <https://doi.org/10.1016/j.jcomdis.2005.03.003>
- Bertelsen, C., Shou, S., Hapner, E. R., & Johns, M. M. (2018). Sociodemographic characteristics and treatment response among aging adults with voice disorders in the United States. *JAMA Otolaryngology - Head & Neck Surgery*, 144(8), 719-726. <https://doi.org/10.1001/jamaoto.2018.0980>
- Berto, Victoria. (2018). "The relationship between perceptions of voice quality and function with self-esteem in older adults". *Theses and Dissertations*. 843. <https://ir.illinoisstate.edu/etd/845>
- Birchall, M. A., & Carding, P. (2019). Vocal nodules management. *Clinical Otolaryngology*, 44(6), 1-5. <https://doi.org/10.1007/BF02993746>
- Britannica. (n.d.). Phonetics. In *Britannica*. <https://www.britannica.com/science/phonetics>
- Butterbaugh, J. (2022). Perceptual Variations in Voice Descriptions for College-Aged Students [https://honors.libraries.psu.edu/files/final\\_submissions/7852](https://honors.libraries.psu.edu/files/final_submissions/7852)
- Cannito, M. P., Jahane, J. C., & Chorna, L. (2008). Vocal aging and adductor spasmodic dysphonia: Response to botulinum toxin injection. *Clinical Interventions in Aging*, 3(1), 131-151. <https://doi.org/10.2147/cia.s1416>
- Carr, Phillip. (2012). *English Phonetics and Phonology: An Introduction* (2nd ed.). John Wiley & Sons.

- Eadie, T. L., Rajabzadeh, R., Isetti, D. D., Nevdahl, M. T., & Baylor, C. R. (2017). The effect of information and severity on perception of speakers with adductor spasmodic dysphonia. *American Journal of Speech-Language Pathology* (online), 26(2), 327-341. [https://doi.org/10.1044/2016\\_AJSLP-15-0191](https://doi.org/10.1044/2016_AJSLP-15-0191)
- Galluzzi, F., & Garavello, W. (2018). The aging voice: a systematic review of presbyphonia. *European Geriatric Medicine*, 9, 559-570. <https://doi.org/10.1007/s41999-018-0095-6>
- Graetzer, S., & Hunter, E. J. (2016). Effects of aging on speech breathing. *Acoustical Society of America*. <https://tinyurl.com/bbbmj66r>
- Hoit, J. D. (1995). Influence of body position and its implication for evaluation and treatment of speech and voice disorders. *Journal of Voice*, 9(4), 341-347. [https://doi.org/10.1016/S0892-1997\(05\)80196-1](https://doi.org/10.1016/S0892-1997(05)80196-1)
- Hoffman, M. R., Jiang, J. J., Rieves, A. L., McElveen, K. A. B., & Ford, C. N. (2009). Differentiating between adductor and abductor spasmodic dysphonia using airflow interruption. *The Laryngoscope*, 119(9), 1851-1855. <https://doi.org/10.1002/lary.20572>
- Izdebski, K. (1992). Symptomology of adductor spasmodic dysphonia: a physiologic model. *Journal of voice*, 6(4), 306-319. [https://doi.org/10.1016/S0892-1997\(05\)80027-X](https://doi.org/10.1016/S0892-1997(05)80027-X)
- Larynx (voice box)* [image]. (2022). NorthShore University Health System. <https://www.northshore.org/healthresources/encyclopedia/encyclopedia.aspx?DocumentHwid=tp12324>
- Lee, Y-S., Lee, D-H., Jeong, G-E., Kim, J-W., Roh, J-L., Choi, S-H., Kim, S-Y., & Nam, S-Y. (2017). Treatment efficacy of voice therapy for vocal fold polyps and factors predictive of its efficacy. *Journal of Voice*, 31(1). 120, <https://doi.org/10.1016/j.jvoice.2016.02.014>
- Li, Y., Garrett, G., Zealear, D. (2017). Current treatment options for bilateral vocal fold paralysis: A state-of-the-art review. *Clinical and Experimental Otorhinolaryngology*, 10(13), 203-212. <https://doi.org/10.21053/ceo.2017.00199>
- Ludlow, C. L. (2011). Spasmodic dysphonia: a laryngeal control disorder specific to speech. *The Journal of Neuroscience*, 31(3), 793-797. <https://doi.org/10.1523/jneurosci.2758-10.2011>
- Menon, A., Mohamed, R., Chemmanchery, V., Vedavyasa, S., & Viswanatha, B. (2020). Vocal cord paralysis - An etiological analysis. *Scholarly Journal of Otolaryngology*, 5(4), 528-532. <https://doi.org/10.32474/SJO.2020.05.000219>
- Misono, S., Peterson, C. B., Meredith, L., Banks, K., Bandyopadhyay, D., Yeuh, B., & Frazier, P. A., (2014). Psychosocial distress presenting in patients with voice concerns, *Journal of Voice*, 28(6), 753-761. <https://doi.org/10.1016/j.jvoice.2014.01.010>

- National Library of Medicine. (n.d.). *Rapid Shallow Breathing*. *Medline Plus*.  
<https://medlineplus.gov/ency/article/007198.htm>
- Phonetics*. (n.d.). Britannica  
<https://www.britannica.com/science/phonetics/Stops>
- Sataloff, R. T., Heman-Ackah, Y. D., & Hawkshaw, M. J. (2007). Clinical anatomy and physiology of the voice. *Otolaryngic Clinics of North America*, 40(5), 909-929.  
<https://doi.org/10.1016/j.otc.2007.05.002>
- Seikel, J. A., Drumright, D. G., & Hudock, D. (2019). *Anatomy & Physiology for Speech, Language, and Hearing* (6th ed.). Plural Publishing.
- Safkat, A., Muzamil, A., & Lateef, M. (2002). A Study of incidence and etiopathology of vocal fold paralysis, *Indian Journal of Otolaryngology and Head & Neck Surgery*, 54(4), 294-296. doi:10.1007/BF02993746
- Source-Filter Theory of Speech* [Image]. (2021). Oxford Research Encyclopedias.  
<https://oxfordre.com/linguistics/display/10.1093/acrefore/9780199384655.001.0001/acrefore-9780199384655-e-894;jsessionid=1071166A632834644ECDB88C113682F2>
- Stemple, J. A., Roy, N., & Klaben, B. K. (2018). *Clinical Voice Pathology: Theory and Management* (6th ed.). Plural Publishing.
- Thijs, Z., Zhang, Y., Van Lierde, Kristiane., Vanryckeghem, M., & Watts, C. R. (2022). Partner perception of affective, behavioral, and cognitive reactions to voice use in people with Parkinson's disease. *Clinical Parkinsonism & Related Disorders*, 7(100152), 1-5.  
<https://doi.org/10.1016/j.prdoa.2022.100152>
- Titze, I.R. (1987). Physiology of the female larynx. *The Journal of the Acoustical Society of America*, 82. <https://doi.org/10.1121/1.2025049>
- Tiwari, Manjul., & Tiwari, Maneesha. (2012). Voice-how humans communicate?. *Journal of Natural Science, Biology and Medicine*, 3(1), 3-11. doi:10.4103/0976-9668.95933
- Tokuda, Isao. (2021). The source-filter theory of speech. *Oxford Research Encyclopedias*,  
<https://doi.org/10.1093/acrefore/9780199384655.013.894>
- UT Southwestern Medical Center, (n.d.) *Aging Voice*.  
<https://utswmed.org/conditions-treatments/aging-voice/>
- Van den Berg, Janwillem, Myoelastic-aerodynamic theory of voice production. *Journal of Speech and Hearing Research*, 1(3), 227-244. <https://doi.org/10.1044/jshr.0103.227>.
- Walden., P. R. (2020). Perceptual voice qualities (PVQD): Database characteristics. *Journal of Voice*, 36(6), <https://doi.org/10.1016/j.jvoice.2020.10.001>

Wang, H-W., Lu, C-C., Chao, P-Z., & Lee, F-P. (2022). Causes of vocal fold paralysis. *Ear, Nose and Throat Journal*, 101(7), 294-298. <https://doi.org/10.1177/0145561320965212>

Wang Tv, Song PC. (2022). Neurological voice disorders: A Review, *International Journal of Head and Neck Surgery*, 13(1), 32-40. doi:20.5005/jp-journals-10001-1521

Zhang, Z. (2021). The physical aspects of vocal health. *Acoustics Today*, 17(3), 60-68. <https://doi.org/10.1121/at.2021.17.3.60>

**ACADEMIC VITA**  
**Rachel Trotti**

**EDUCATION:**

**Pennsylvania State University – University Park, PA**

- Bachelor of Science in Communication Science and Disorders Expected May 2023
- Bachelor of Science in French and Francophone Studies Expected May 2023
- Member of the Schreyer Honors College

**Research – Pennsylvania State University**

- Honors Thesis in Communication Sciences and Disorders
- Part of the Orofacial Physiology and Perceptual Analysis Lab (OPPAL)

**AWARDS & HONORS:**

- Dean’s List (Fall 2019, Spring 2019, Fall 2020, Spring 2020, Fall 2021, Fall 2022)
- Recipient of the Jane B. Slep Honors scholarship
- Recipient of Academic Excellence Scholarship
- Member of the Pi Delta Phi honor society

**EXPERIENCES:**

**Study Abroad: Institute for American Universities – Aix-en-Provence**

- Studied in Aix-en-Provence, France for the Spring 2022 semester
- Practiced French language skills while being immersed in a new country’s culture
- Member of the IAU French Honors Program

**Teacher Aide: *Since May 2021***

- Works as a teacher aide to engage, support and teach children who have been diagnosed with autism spectrum disorder
- Utilizes Applied Behavioral Analysis (ABA) to help students achieve individualized goals

**Babysitter:**

- Ensured the safety of children while providing a fun and engaging environment
- Learned how to properly and safely care for children with complex medical needs

**Swim Instructor: Saf-t-Swim - *March 2016 - August 2019***

- Provide individual swim lessons to children ages six months to thirteen years of age
- Tailored lessons to teach children of all swim abilities how to swim
- Assessed readiness of children to move to higher swim skill levels