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Listeners' Attitudes Towards Young Women with Glottal Fry

A thesis

presented to

the faculty of the Department of Audiology and Speech-Language Pathology of

East Tennessee State University

In partial fulfillment

of the requirements for the degree

Master of Science in Speech-Language Pathology

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by

Natalie Breanne Foulks

May 2020

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Key words: glottal fry, listeners' attitudes, hirability, young women

ABSTRACT

Listeners' Attitudes Towards Young Women with Glottal Fry

by

Natalie Foulks

Objective: The purpose of this study was to identify employers' perceptions of young women using glottal fry and the impact on hirability.

Methods: A survey was created using the online survey tool, REDCap®, and sent to employers across the southern United States. The survey contained audio samples consisting of a non-glottal fry voice, a glottal fry at the end of sentences voice, and a continuous glottal fry voice, fourteen semantic differential scales derived from hiring constructs, and open-ended questions on hirability.

Results: Employers perceived individuals using glottal fry more negative than the individual who used no glottal fry. Employers indicated they were less likely to hire individuals who use glottal fry compared to individuals who do not use glottal fry.

Conclusion: The presence of glottal fry negatively impacts employers' perceptions of young women and her perceived hirability. These results demonstrate the relationship between vocal quality and listener perceptions.

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DEDICATION

In loving memory of Mrs. Nell Spradling.

ACKNOWLEDGEMENTS

First, I would like to thank Dr. Chaya Guntupalli for all of her support and guidance both on this project and throughout my graduate school journey. I cannot express how grateful I am for you generously gifting me with your time, knowledge, and talent. Thank you for sharing your love of voice and research with me. It has truly been an honor to work with and learn from you.

To Dr. Brenda Louw, Dr. Allen Gorman, and Dr. Miriam vanMersbergen, thank you for generously serving on this committee and sharing your time and expertise with me. This project could not have been completed without each of your contributions. It has been a blessing to know and work with each of you.

To my wonderful parents, Mark and Pam Foulks, thank you for always believing in me and supporting me. Your continuous love and encouragement is the biggest blessing I could ask for.

To my siblings, Baylie and Evan, and sweet friends, Ali, Emmy, Katy, and Kendall, thank you for your constant support and encouragement. Thank you for believing in me and helping me along this process.

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CHAPTER 1

INTRODUCTION

This study aimed to evaluate listeners' attitudes towards young women who use glottal fry. Specifically, employers' perceptions of young women using glottal fry and the impact of these perceptions on hirability were examined. It is anticipated that this study will serve to expand the understanding of the impact of glottal fry in different linguistic contexts (i.e., end of sentences fry, continuous fry) on young women's performance during the hiring process, specifically a structured interview. This may lead young women to utilize an optimal vocal quality that will enhance their performance during a structured job interview. Further, this study may add to the existing literature on the impact of voice and vocal quality on listeners' attitudes and perceptions.

The following sections will provide an in-depth understanding of the existing literature on the prevalence of glottal fry, the characteristics of this vocal register, and listener attitudes towards those individuals using glottal fry.

CHAPTER 2

REVIEW OF THE LITERATURE

Voice and Vocal Registers

Voice defines a person's identity. Voice is produced by tiny structures, the vocal folds. These structures create a distinctive vocal sound, which varies across age and gender. The distinctive sound is the fundamental frequency, which is defined as the optimal rate of vocal fold vibration determined by individual factors, such as vocal fold length, mass, and tension (Stemple Roy, & Klaben, 2018; Zemlin, 1998). Typically, adult males are expected to produce a fundamental frequency of 100-110 Hz, while adult females are expected to produce a fundamental frequency of 200-220 Hz (Stemple et al., 2018).

During each cycle of vibration, vocal folds exhibit a specific pattern of vibration also known as mode of vibration. These different modes of vibration are termed vocal registers (Hollien, 1974; Seikel, Drumright, & King, 2015). Vocal registers are perceptually distinct modes of vocal phonation that are achieved through the modification of the vocal fold vibratory patterns (Hollien, 1974; Seikel et al., 2015; Zemlin, 1998). There are three main vocal registers that encompass a wide range of lowest to highest frequencies: glottal fry, modal, and falsetto registers (Jiang, Lin, & Hanson, 2000; Seikel et al., 2015). Glottal fry, also known as pulse register, is typically described as the lowest register and is characterized by a creaky vocal quality (Hollien, Moore, Wendahl, & Michel, 1966). On the other hand, the modal register, used in daily conversations, is described as the mode of vibration comprising an individual's fundamental frequency, which encompasses the optimal and habitual speaking pitch (Jiang et al., 2000; Seikel et al., 2015). The falsetto register is described as the highest frequency an

individual can produce and is characterized by an extremely thin, high-pitched vocal production. Voice registers create unique vocal qualities in speakers ranging from a low-pitched, creaky voice to a high-pitched, thin voice. Modal phonation is an expected standard phonatory pattern, however, glottal fry has been increasingly prevalent in the recent years. The following section will provide information on the prevalence of glottal fry across genders, certain cultures, occupations, and linguistic contexts.

Prevalence of Glottal Fry

The increased prevalence of glottal fry in the speech of celebrities and political figures, such as Gwyneth Paltrow, Reese Witherspoon, Renee Zellweger, and the Kardashian sisters, has led to an increasing predominance of glottal fry in American English speakers (Blum, 2016; Pennock, 1989). Glottal fry is more prevalent across certain cultures, genders, occupations, and linguistic contexts than others. Please see table 1 for an overview of existing research on the prevalence of glottal fry. American female speakers use glottal fry twice as often as their Japanese female counterparts (Yussa, 2010). The increased prevalence of glottal fry in the speech of American females may be due to pragmatic characteristics (i.e., a method to portray authority) and the increased prevalence of this register in the American media (Blum, 2016; Yussa, 2010).

Additionally, glottal fry is more predominant in young college-age women than their male counterparts (4:1) in conversational sentence tasks (Abdelli-Beruh, Wolk, & Salvin, 2014; Wolk, Abdelli-Beruh, & Salvin, 2012). However, no significant differences were reported between the prevalence of glottal fry in college-aged and middle-aged women (Oliveria, Dodson, Holczer, Kaplan, & Paretzky, 2016). Glottal fry is becoming a predominant vocal

pattern of specific professions, especially in female dominated fields. Specifically, 30% of speech language pathologists (SLPs) were found to be significant users of glottal fry (Glottliebson, Lee, Weinrich, & Sanders, 2007).

Previous literature has speculated potential reasons for the increased prevalence of glottal fry in the speech of young women, such as media influence (Anderson et al., 2014; Blum, 2016; Pennock, 1998). A common hypothesis on the use of glottal fry is that young women utilize this vocal register as a feminine marker of authority, especially in the workplace (Anderson et al., 2014; Wolk et al., 2012; Yussa, 2010). In other words, it is believed that young American women use glottal fry to mimic the vocal qualities of males to better compete with them in a competitive job market (Anderson et al., 2014; Yussa, 2010). However, there is no known research that examines the cause of the increased prevalence of glottal fry in the speech of young American women.

Glottal fry appears to occur more in some linguistic contexts than others. This vocal pattern is produced more in sentence reading and conversational speaking and specifically, at the end of sentences in comparison to the beginning or the middle of sentences (Abdelli-Beruh et al., 2014; Oliveira et al., 2016; Wolk et al., 2012). Conversational entrainment, or the tendency for individuals to align their behaviors (e.g., vocal patterns) with those of their conversational partner may also influence the prevalence of glottal fry in young women (Borrie & Delfino, 2017). In other words, young female speakers use significantly more glottal fry when speaking with a communicative partner using glottal fry in comparison to speaking with a partner not using glottal fry (Borrie & Delfino, 2017).

Table 1

Overview of Existing Literature on the Prevalence of Glottal Fry

<table>
<tr><th>Author</th><th>Participants/Task</th><th>Outcome Measures</th><th>Results</th><th>Implications</th></tr>
<tr><td>Abdelli-Beruh, Wolk, & Slavin (2014)</td><td>• Participants: male college age students
• Tasks: Three sustained /a/ productions and 6 sentences readings</td><td>• Perceptual evaluations of occurrence of glottal fry by trained SLPs
• Compared results to results on female use of fry from Wolk et al. (2012)</td><td>• Males used glottal fry in the end of sentences in the conversational reading task but not in the sustained vowel production task
• Females produced 4 times the amount of glottal fry as the males in the conversational reading task</td><td>• Differences in linguistic contexts may serve as a social identifier
• Gender differences may be due to pragmatic and communicative style differences</td></tr>
<tr><td>Borrie & Delfino (2017)</td><td>• Participants: College age females
• Task: Conversations with a partner using modal or fry registers</td><td>• Frequency of glottal fry occurrence measured by percent vocal fry (PVF) in conversational task compared to baseline</td><td>• Percent vocal fry was higher when speaking with a communicative partner using glottal fry
<table><tr><th></th><th>Mean PVF</th></tr><tr><td>Glottal Fry Partner</td><td>15.01</td></tr><tr><td>Non-Fry Partner</td><td>9.02</td></tr></table></td><td>• Conversational entrainment may result in increased prevalence and leads to increased conversational enjoyment</td></tr>
<tr><td>Glottliebson, Lee, Weinrich, & Sanders (2007)</td><td>• Participants: graduate speech pathology students
• Task: Voice evaluations</td><td>• Presence of voice problems in speech language pathology students as determined by voice evaluations conducted by SLPs</td><td>• 31 (29.8%) of the 104 students sampled were judged to use glottal fry
• Glottal fry was the most prevalent voice characteristic observed in the SLP students</td><td>• High prevalence of SLPs using glottal fry may be due to gender differences or prevalence in the media</td></tr>
<tr><td>Oliveria, Dodson, Holczer, Kaplan, & Paretzky (2016)</td><td>• Participants: College age and middle age women
• Tasks: Conversational speaking tasks</td><td>• Occurrence of glottal fry (fry/minute)
• Frequency of glottal fry in initial medial and final positions</td><td><table><tr><th></th><th>Young Women</th><th>Older Women</th></tr><tr><td>Fry/Minute</td><td>13.8</td><td>11.4</td></tr><tr><td>Initial</td><td>9.1</td><td>6.9</td></tr><tr><td>Medial</td><td>10.5</td><td>7.6</td></tr><tr><td>Final</td><td>13.9</td><td>12.2</td></tr></table></td><td>• Increased prevalence of glottal fry in young and middle age women may be due to prevalence in the media per authors</td></tr>
<tr><td>Wolk, Abdelli-Beruh, and Slavin (2012)</td><td>• Participants: college age American females
• Tasks: Three sustained /a/ productions and 6 sentences readings</td><td>• Perceptual evaluations of occurrence of glottal fry by trained SLPs</td><td>• Glottal fry was identified in the conversational speech of young females
• Glottal fry rarely occurred in sustained vowels but frequently occurred in conversational speech
• Glottal fry occurred most frequently at the end of sentences</td><td>• Increased prevalence of glottal fry likely due to influence of media per authors
• Glottal fry is a normalized register despite unknown impact on vocal folds</td></tr>
<tr><td>Yussa (2010)</td><td>• Participants: College age Japanese females, American males and females,
• Tasks: conversational speaking tasks</td><td>• Frequency of occurrence of glottal fry
○ Determined by number of words containing glottal fry in conversational sample</td><td><table><tr><th></th><th>Total Incidents</th><th>Average Incidents</th></tr><tr><td>American Females</td><td>595</td><td>49.2</td></tr><tr><td>American Males</td><td>246</td><td>27.5</td></tr><tr><td>Japanese Females</td><td>275</td><td>22.4</td></tr></table></td><td>• Increased prevalence of fry in American females is likely due to pragmatic aspects and popularity of fry in American media</td></tr>
</table>

Characteristics of Glottal Fry

Glottal fry is characterized by unique perceptual, acoustic, aerodynamic, and physiologic parameters in comparison to modal register. The follow sections will outline the specific characteristics of glottal fry.

Auditory-Perceptual Characteristics

Auditory-perceptual characteristics refer to the interpretation of perceived vocal quality by listeners (e.g., breathy, high pitched, rough). From an auditory-perceptual perspective, glottal fry is perceived as a low, creaky vocal quality, similar to a crackly “popcorn quality” or a “I am a sick voice” (Hollien et al., 1966; Jiang et al., 1974; Seikel et al., 2015). Perceptions of glottal fry are distinct, and individuals are able to perceive glottal fry as a much “lower voice” even when the fundamental frequency was within the modal register (Bloomgren, Chen, Ng, & Gilbert, 1998; Kaung & Liberman, 2016). Please see table 2 for an overview of the existing literature on auditory perceptual characteristics of glottal fry.

Table 2

Overview of Existing Literature on the Auditory-Perceptual Characteristics of Glottal Fry

<table>
<tr><th>Author</th><th>Participants/ Task</th><th>Outcome Measures</th><th>Results</th><th>Implications</th></tr>
<tr><td>Bloomgren, Chen, Ng, & Gilbert (1998)</td><td>• Participants: undergraduate and graduate students
• Task: identification of sustained /a/ recordings</td><td>• Ability of students to distinguish between modal and glottal fry registers</td><td>• Correct Identification of Each Register:
<table><tr><th></th><th>Mean</th><th>Percent</th><th>Range</th></tr><tr><td>Modal Register</td><td>19.04</td><td>95.5%</td><td>16-20</td></tr><tr><td>Glottal Fry Register</td><td>20</td><td>100%</td><td>20</td></tr></table></td><td>• Glottal fry is perceptually different from modal phonation due to unique acoustic, aerodynamic and physiologic characteristics</td></tr>
<tr><td>Kaung & Liberman (2016)</td><td>• Participants: college age Americans
• Tasks: forced-choice identification tasks</td><td>• Identification of glottal fry in the presence of other factors (i.e., varying fundamental frequencies, jitter) by college age Americans</td><td>• Listeners are less likely to identify a sample as having a high pitch in the presence of fry even if the F0 was higher</td><td>• The aperiodicity of glottal fry likely results in the perception of this register being low pitch despite high F0</td></tr>
</table>

Acoustic Characteristics

Acoustic characteristics provide information on vocal function and its impact on vocal parameters assessed including fundamental frequency, intensity, and noise to harmonic ratio (Stemple et al., 2018). The perceived lower and creaky vocal quality of glottal fry is directly correlated with the measured acoustic parameters of glottal fry. Specifically, the perception of lower pitch is correlated with the measured lower frequency during the production of glottal fry. This was evidenced in a study where both male and female participants produced a frequency of 49.14 Hz and 48.1 Hz respectively in the glottal fry register (Bloomgren et al., 1998). This was in stark contrast to their fundamental frequency in their modal register (males:

117 Hz, females: 211 Hz). Males and females maintained gender related norms for fundamental frequency during modal phonation, but produced a much lower frequency during glottal fry phonation, which resulted in the perception of "low" vocal qualities (Bloomgren et al., 1998; Chen, Robb, & Gilbert, 2002; Hollien & Wendahl, 1968). Please see table 3 for an overview of existing literature on acoustic characteristics of glottal fry.

Table 3

Overview of Existing Literature on the Acoustic Characteristics of Glottal Fry

<table>
<tr><th>Author</th><th>Participants/Task</th><th>Outcome Measures</th><th>Results</th><th>Implications</th></tr>
<tr>
<td>Bloomgren, Chen, Ng, & Gilbert (1998)</td>
<td>• Participants: 20 speakers using modal register and simulated glottal fry
• Tasks: sustained vowels / i, a, ae, u/</td>
<td>• Fundamental Frequency (F0)
• Jitter
• Shimmer
• Signal to Noise Ratio (S/N ratio)</td>
<td>
<table>
<tr><th></th><th colspan="2">Modal</th><th colspan="2">Glottal Fry</th></tr>
<tr><th></th><th>Males</th><th>Females</th><th>Males</th><th>Females</th></tr>
<tr><td>F0 (Hz)</td><td>117.5</td><td>211.0</td><td>49.14</td><td>48.1</td></tr>
<tr><td>Jitter (%)</td><td>1.23</td><td>1.79</td><td>14.9</td><td>8.8</td></tr>
<tr><td>Shimmer (dB)</td><td>.40</td><td>.38</td><td>1.41</td><td>1.38</td></tr>
<tr><td>S/N Ratio</td><td>13.27</td><td>12.84</td><td>.067</td><td>1.29</td></tr>
</table>
</td>
<td>• Aperiodic vibratory patterns result in significantly lower F0 in glottal fry
• Increased jitter and shimmer indicate decreased phonatory stability in fry
• Decreased S/N ratio indicates higher noise energy in fry</td>
</tr>
<tr>
<td>Chen, Robb, & Gilbert (2002)</td>
<td>• Participants: 10 speakers using modal register and simulated glottal fry
• Tasks: sustained / i, a, ae, u/</td>
<td>• Fundamental Frequency</td>
<td>• Fundamental frequency on sustained vowel productions:
<table>
<tr><th></th><th>Males</th><th>Females</th></tr>
<tr><td>Modal Register</td><td>106 Hz</td><td>204 Hz</td></tr>
<tr><td>Glottal Fry Register</td><td>45 Hz</td><td>42 Hz</td></tr>
</table>
</td>
<td>• Reduction in F0 in glottal fry is likely due to vocal fold stiffness and decreased subglottic pressure</td>
</tr>
<tr>
<td>Hollien & Wendahl (1968)</td>
<td>• Participants: 8 male listeners (4 trained and 4 untrained listeners)
• Task: Identification of glottal fry</td>
<td>• Frequency matching of glottal fry productions</td>
<td>• Glottal fry is produced with a fundamental frequency well below what is expected
○ Range: 31.6-69.1 Hz</td>
<td>• Fry has an average F0 lower than modal register; authors believe could lead to voice disorders</td>
</tr>
</table>

Aerodynamic Characteristics

Aerodynamic characteristics include those elements that assess the physiologic vocal function to provide information on the glottal valving mechanism (Stemple et al., 2018). Specifically, aerodynamic characteristics pertain to how airflow moves from the respiratory system through the laryngeal mechanism to produce voice and are captured using subglottic pressure and airflow (Stemple et al., 2018). Overall, glottal fry is associated with a lower subglottic pressure and airflow (Bloomgren et al., 1998). The lower airflow may correlate with the perception of a rough, creaky vocal quality. Please see table 4 for an overview of existing literature on aerodynamic characteristics of glottal fry.

Table 4

Overview of Existing Literature on Aerodynamic Characteristics of Glottal Fry

<table>
<tr><th>Author</th><th>Participants/Task</th><th>Outcome Measures</th><th>Results</th><th>Implications</th></tr>
<tr>
<td>Bloomgren, Chen, Ng, & Gilbert (1998)</td>
<td>• Participants: 20 speakers using modal register and simulated glottal fry
• Tasks: sustained vowels (e.g., /i, a, ae, u/) and 7 continuous /pi/ syllables</td>
<td>• Airflow
○ Measured by average peak airflow in ml/s
○ Assessed in sustained vowels and syllable productions
• Air Pressure
○ Measured by peak intraoral pressure in cm H2O
○ Assessed in syllable productions</td>
<td>
<table>
<tr><th colspan="5">Airflow (measured in ml/s)</th></tr>
<tr><td></td><td colspan="2">Sustained Vowel</td><td colspan="2">Syllable Production</td></tr>
<tr><td></td><td>Modal</td><td>Fry</td><td>Modal</td><td>Fry</td></tr>
<tr><td>Males</td><td>213.7</td><td>69.7</td><td>648.9</td><td>258.0</td></tr>
<tr><td>Females</td><td>154.6</td><td>58.2</td><td>438.0</td><td>175.1</td></tr>
</table>
<table>
<tr><th></th><th colspan="2">Air Pressure (measured in cm H2O)</th></tr>
<tr><td></td><td>Modal</td><td>Fry</td></tr>
<tr><td>Males</td><td>7.45</td><td>5.51</td></tr>
<tr><td>Females</td><td>7.56</td><td>5.25</td></tr>
</table>
</td>
<td>• Similar airflow across both genders is likely due to similar vocal fold vibratory patterns.
• Reduced air pressure across both genders was secondary to decreased tension and less pressure to force vocal folds apart</td>
</tr>
</table>

Visual Perceptual/Imaging Characteristics

Imaging/visual perceptual characteristics describe how the vocal folds perform during phonation with a specific emphasis on the vibratory characteristics (i.e., glottal closure, glottal amplitude, and phase symmetry). Glottal fry is characterized by unique pulse repetitions and vibratory patterns when compared to modal register phonation (Bloomgren et al., 1998; Chen et al., 2002). These patterns have ranged from single opening and closing to multiple opening and closing of the vocal folds, and increased closing duration than opening duration. In addition to the unique pulse repetitions and aperiodic vibratory patterns, glottal fry phonation is physiologically characterized by reduced tension along the free edges of the vocal folds, aperiodic vibratory patterns, and unique pulse repetitions. These characteristics correlate with the specific features of glottal fry , including low airflow, low frequency, and rough vocal quality (Bloomgren et al., 1998; Chen et al., 2002). See table 5 for an overview of visual perceptual characteristics of glottal fry.

Table 5

Overview of Existing Literature on Visual Perceptual Characteristics of Glottal Fry

<table>
<tr><th>Author</th><th>Participants/ Task</th><th>Outcome Measures</th><th>Results</th><th>Implications</th></tr>
<tr>
<td>Bloomgren, Chen, Ng, & Gilbert (1998)</td>
<td>• Participants: 20 speakers using modal register and simulated glottal fry
• Tasks: Three sustained /a/ productions and 6 sentences readings</td>
<td>• Peaks-per-cycle
○ Waves were identified as complex repetitive if they had more than one peak-per-cycle
○ Classified as doublet or triplet cycles</td>
<td>Occurrence of Complex Repetitive Waves in Glottal Fry Phonation:
<table>
<tr><th></th><th>Males</th><th>Females</th></tr>
<tr><td>Occurrence of Complex Repetitive Waves</td><td>99/120</td><td>45/120</td></tr>
<tr><td>Percentage of Complex Repetitive Waves</td><td>83%</td><td>38%</td></tr>
<tr><td>Occurrence of Doublet Cycles</td><td>56%</td><td>87%</td></tr>
<tr><td>Occurrence of Doublet and Triplet Cycles</td><td>44%</td><td>13%</td></tr>
</table>
</td>
<td>• The higher incidence of complex repetitive waves in glottal fry may be due to the shortened and thickened vocal folds</td>
</tr>
<tr>
<td>Chen, Robb, & Gilbert (2002)</td>
<td>• Participants: 10 speakers using modal register and simulated glottal fry
• Tasks: sustained vowels (e.g., / i, a, ae, u/)</td>
<td>• Closing Phase: time between lowest amplitude and highest amplitude.
• Opening Phase: time span between the amplitude peak and next amplitude valley.
• Speed Quotient: ratio of opening phase to closing phase duration.</td>
<td>
<table>
<tr><th></th><th colspan="2">Modal</th><th colspan="2">Glottal Fry</th></tr>
<tr><th></th><th>Males</th><th>Females</th><th>Males</th><th>Females</th></tr>
<tr><td>Closing Phase (m/s)</td><td>3.96</td><td>1.62</td><td>10.76</td><td>3.29</td></tr>
<tr><td>Opening Phase (m/s)</td><td>5.86</td><td>3.35</td><td>14.34</td><td>24.71</td></tr>
<tr><td>Speed Quotient</td><td>1.59</td><td>2.44</td><td>1.99</td><td>10.15</td></tr>
</table>
</td>
<td>• Speed quotient was significantly higher in vocal fry phonation likely due to the anatomical differences (i.e., thicker vocal folds, shorter vocal folds, decrease in subglottic pressure and airflow, decreased Bernoulli effect, etc.)</td>
</tr>
</table>

Summary and Impact

Overall, there is a correlation between the auditory-perceptual characteristics of glottal fry and the acoustic, aerodynamic, and visual perceptual characteristics. Despite the finding of decreased subglottic pressure in glottal fry phonation, prior research found increased vocal effort following continuous production of glottal fry in comparison to the vocal effort ratings obtained after modal phonation (Bloomgren et al., 1998; Venkatraman & Sivasankar, 2018). Additionally, Glottliebson et al. (2007) concluded that prolonged use of glottal fry in professional voice users can lead to further voice problems. Literature on the long-term impact of glottal fry is limited. Therefore, further research is necessary to discern the physiologic impact of long-term use of glottal fry on overall vocal health and function, which is not within the purview of this study.

Impact of Glottal Fry Phonation on Listeners' Attitudes

Listeners make judgements about an individual based on their vocal quality (Amir & Levine-Yundof, 2013; Baus, McAleer, Marcoux, Belin, & Costa, 2019). Prior research has demonstrated that an individual's voice can create perceptions of personality characteristics (Amir & Levine-Yundof, 2013; Baus et al., 2019). Recent studies on the evaluation of the impact of glottal fry on listener perceptions have revealed negative perceptions (Anderson, Kolfstad, Mayew, & Venkatachalam, 2014; Venkatraman & Sivasankar, 2018). Specifically, female speakers with glottal fry were perceived to be less trustworthy, less competent, less educated, less attractive, less intelligent, less likable, and more unnatural than both their female and male counterparts who did not use glottal fry (Anderson et al., 2014; Venkatraman & Sivasankar, 2018). Additionally, listeners reported having to use increased concentration in order to

understand a message being conveyed by a speaker using glottal fry (Venkatraman & Sivasankar, 2018). The increase in cognitive demand needed to understand a speaker using glottal fry could further contribute to negative perceptions and create a breakdown in communication.

As a consequence of negative perceptions towards glottal fry, specifically on traits of trustworthiness and education, speakers who use glottal fry have a limited chance of hirability compared to those who do not use glottal fry (Anderson et al., 2014; Venkatraman & Sivasankar, 2018). Prior studies have used varying means to assess the perceived hirability of glottal fry including forced choice methods (i.e., which speaker is more hirable?) and rating scales (Anderson et al., 2014; Venkatraman & Sivasankar, 2018). The existing literature on the hirability of glottal fry is limited on quality of voice samples, including reading passages (e.g., the Rainbow passage) or single sentence samples (Anderson et al., 2014; Venkatraman & Sivasankar, 2018).

In contrast, literature seems to be varied regarding listeners' age and their perceptions of glottal fry. Younger listeners (i.e., college students) have found speakers using glottal fry as sophisticated, confident, professional, more educated, more genuine, non-aggressive, urban, and mature (Ligon, Rountrey, Rank, Hull, & Khidr, 2018; Yussa, 2010). On the contrary, younger individuals also used some negative terms to describe the speaker using glottal fry including housewife, less confident, and rural (Yussa, 2010). Elementary school-aged students preferred a mildly-dysphonic speaker (representative of a glottal fry) to that of a speaker using modal phonation. Elementary school students perceived the teacher using glottal fry to be nicer, braver, smarter, friendlier, more trustworthy, and more fair than the teacher using modal

phonation (Smith et al., 2018). Irrespective of the varied literature, in general, younger individuals tend to perceive speakers with glottal fry as overall more positive than speakers of modal phonation (Ligon et al., 2018; Smith et al., 2018; Yussa, 2010). Because younger individuals are more likely to use glottal fry, younger listeners may tend to have a more favorable view of speakers who use this vocal register (Abdelli-Beruh et al., 2014; Wolk et al., 2012; Yussa, 2010). Likewise, based on trends observed in existing literature, speakers who are not exposed to or do not use glottal fry might view glottal fry less favorably than modal phonation (Anderson et al., 2014; Yussa, 2010). Please see table 6 for an overview of the existing literature on listeners' attitudes towards glottal fry.

Table 6

Overview of Existing Literature on Listeners' Attitudes towards Glottal Fry

<table>
<tr><th>Author</th><th>Participants/Task</th><th>Outcome Measures</th><th>Results</th><th>Implications</th></tr>
<tr><td>Anderson, Klofstad, Mayew, & Venkatachalam (2014)</td><td>• Participants: 800 survey respondents
• Task: Forced choice task of perception of glottal fry based of voice samples</td><td>• Impact of glottal fry on perceptions of:
○ Education
○ Competence
○ Trustworthiness
○ Attractiveness
○ Hirability</td><td>• Female speakers were judged to be less educated, less competent, less trustworthy, and less hirable if using glottal fry.
• Glottal fry was perceived negatively regardless of age of listener
○ Older listeners perceived glottal fry more negatively than younger listeners</td><td>• Females are perceived negatively when using glottal fry, likely due to sex-atypical vocal pitch.</td></tr>
<tr><td>Ligon, Rountrey, Rank, Hull, & Khidr (2018)</td><td>• Participants: 23 SLP students
• Tasks: Rating desirability of on audio samples of voice types on a 3-point scale</td><td>• Perception of vocal qualities (glottal fry, breathy, high-pitched, weak voice, low-pitched, loud, rough, strained)</td><td>• Glottal fry was perceived as mostly negative
○ 7 of 23 participants used negative adjectives (i.e., vain, depressed, etc.) to describe glottal fry
○ 14 of 23 participants used mixed adjectives (i.e., obnoxious, flirty, chill, vain, manly, etc.) to describe fry</td><td>• The mixed perception of glottal fry may be due to the participants' use of fry or their knowledge of voice.</td></tr>
<tr><td>Smith, Campolongo, Garretson, Marley, Waters & Nanjundeswaran (2018)</td><td>• Participants: 22 elementary school children
• Tasks: Ranking speakers on semantic differential scales</td><td>• Impact of voice types (i.e., non-dysphonic, glottal fry, moderately-severe dysphonic) on perceptions of personality characteristics</td><td>• Speakers using glottal fry were perceived better than the non-dysphonic speaker
○ Glottal fry speaker was found to be nicer, more fun, happier, more caring, more friendly, more fair, smarter, and more trustworthy than the. non-dysphonic speaker.</td><td>• Children appear to prefer glottal fry to modal register.
• Glottal fry may be the new "norm"</td></tr>
<tr><td>Venkatachalam & Sivasankar (2018)</td><td>• Participants: 10 American adults raters;
• Task: Rating voice samples (5 male and 5 females reading the Rainbow passage using modal and glottal fry registers)</td><td>• Impact of glottal fry on perceptions of:
○ Employability
○ Amount of concentration required to understand speaker
○ Naturalness of speaker</td><td>• Perceptions of glottal fry on the rating scale
<table><tr><th></th><th>Modal</th><th>Glottal Fry</th></tr><tr><td>Employability</td><td>0.24</td><td>7.27</td></tr><tr><td>Concentration Required</td><td>1.78</td><td>4.53</td></tr><tr><td>Naturalness</td><td>2.31</td><td>6.47</td></tr></table>• Glottal fry was rated as less employable, less natural, and requiring greater concentration than modal register</td><td>• Negative perceptions of glottal fry may be due to the increased concentration and cognitive capacity required to understand speakers using glottal fry</td></tr>
<tr><td>Yussa (2010)</td><td>• Participants: 175 college age American females
• Tasks: Rating of modal and glottal fry voice samples on contrasting adjective sets and open-ended questions</td><td>• Impact of glottal fry on the perceptions of:
○ Overall impressions of the speaker
○ Personality characteristics</td><td>• The majority of participants (98) perceived the glottal fry speaker to be urban-oriented or upwardly mobile (e.g., professional, etc.,)
• The glottal fry voice was perceived to be more educated, more intimate, more genuine, more casual and less aggressive
○ Glottal fry was perceived to neutral on the confident/hesitant adjective set</td><td>• Glottal fry is perceived more positively by young women due to increased prevalence and to "compete" with male vocal quality.</td></tr>
</table>

Summary of Glottal Fry and Gaps in the Existing Literature

Literature on glottal fry is limited. Specific focus of prior literature includes the identification of the characteristics of glottal fry (i.e., auditory perceptual, acoustics, aerodynamic and imaging) and the impact of glottal fry on listener perceptions. Methodological differences can be identified across these studies (see tables 1, 2, 3, 4, 5, and 6). Specifically, prior literature has assessed listener attitudes towards glottal fry in a variety of ages and populations. In addition, the following gaps in the literature were observed with a focus on assessing employers' perceptions towards glottal fry and the impact of these perceptions on hirability (a) perceptions of employers towards glottal fry, (b) evaluating traits and characteristics that are specific to those utilized by employers during the hiring process, (c) utilizing a simulated interview prompt as auditory stimuli, (d) evaluating the perceptions of glottal fry in various linguistic contexts (i.e., end of sentences, continuous glottal fry), and (e) utilizing employers as respondents to determine perception of hirability.

Hiring Constructs

During an interview process, employers capture certain constructs to determine a candidate's work-related characteristics and probable performance if hired. These constructs include, but are not limited to cognitive ability, motivation, social skills, and person-organization fit (Huffcutt, Conway, Roth, & Stone, 2001). Employers often utilize two types of constructs during the hiring process: predictor constructs and criterion constructs (Sackett & Lievens, 2008). Criterion constructs assess probable job performance and ability to perform job tasks, such as task proficiency, effort, and maintaining personal discipline (Sackett & Lievens, 2008). Predictor constructs consist of psychological characteristics, such as personality traits

and are typically measured during a structured interview (Huffcutt et al., 2001; Sackett & Lievens, 2008). Specifically, predictor constructs were found to be highly valid in determining job performance, especially in team-based jobs (Huffcutt et al., 2001; Morgeson, Reider, &Campion, 2005). See table 7 for an overview of these constructs.

Of the identified hiring constructs, the constructs of mental capability, personality tendencies, and applied social skills were determined to be the most frequently assessed constructs during an interview (Huffcutt et al., 2001). While the constructs relating to knowledge and skills, interests and preferences, and organizational fit are typically determined by a candidate's prior experience, the constructs related to mental capabilities, personality tendencies, and applied social skills can be, in part, determined by a candidate's voice. Therefore, the constructs of mental capabilities, personality tendencies, and applied social skills were identified as pertinent to the current study.

Table 7

Description of Hiring Constructs

Hiring Construct	Description
Mental Capabilities	The overall ability to learn and process information (i.e., general intelligence, applied mental skills, etc.)
Knowledge and Skills	Information stored in long-term memory; includes declarative (i.e., terms, , names, etc.,) and procedural (i.e., skills, operations, etc.)
Personality Tendencies	Long-term predispositions to act certain ways; described on 5 dimensions: Extroversion, Conscientiousness, Agreeableness, Openness to Experience, and Emotional Stability
Applied Social Skills	The ability to function effectively in social situations (i.e., oral communication skills, interpersonal skills, leadership, etc.)
Interests and Preferences	An inclination towards certain areas or activities (i.e., preference for geographical area, interest in related hobbies, etc.)
Organizational Fit	The proximity of the candidate's values and attitudes align with those of the company or organization
Physical Appearance	Can include general physical characteristics (i.e., attractiveness) or job-related characteristics (i.e., stamina, agility, etc.)

Note: Descriptions of constructs derived from the taxonomy detailed in Huffcutt et al. (2001).

Existing literature on the perceived hirability of glottal fry has utilized some hiring constructs (Anderson et al., 2014). However, these constructs were superficially evaluated and did not prioritize those constructs most frequently assessed in the interview process (Anderson et al., 2014; Huffcutt et al., 2001). The current study aimed to expand on the understanding of employers' perceptions of glottal fry pertaining to hiring constructs utilized in the interview process and how these perceptions can impact hirability. See table 8 for an overview of previously assessed hiring constructs and the constructs assessed in the current study. Prior research examining hiring constructs examined the constructs in a forced choice task (e.g., "which candidate is more educated?"); the current study aimed to analyze the extent to which glottal fry impacts employer perceptions of the hiring construct traits (Anderson et al., 2014). Therefore, the current study utilized contrastive adjective sets (i.e., semantic differential scales) utilizing a visual analog scale (VAS) of 0-100.

Table 8

Hiring Constructs in Previous Literature and the Current Study

Hiring Construct	**Anderson et al., 2014**	**Current Study**
Mental Capabilities	• N/A	• Intelligent/Unintelligent
Personality Tendencies	• Competent • Trustworthy	• Nice/Rude • Friendly/Grouchy • Trustworthy/Dishonest • Confident/Hesitant • Flexible/Rigid • Energetic/Lazy • Motivated/Unmotivated • Positive Attitude/Negative Attitude • Approachable/Unapproachable
Applied Social Skills	• N/A	• Leader/Follower • Good Communicator/Bad Communicator • Collaborative/Solitary
Knowledge and Skills	• Educated	• N/A
Physical Appearance	• Attractive	• N/A

Purpose of the Current Study

The broad aim of this study is to identify listener attitudes towards young women using glottal fry. Specifically, the current study seeks to understand employers' (a) ability to identify glottal fry, (b) perceptions of young women using glottal fry utilizing variables from hiring constructions, and (c) perceptions of the hirability of young women who use glottal fry.

CHAPTER 3

METHODS

Aims

This study aims to determine employers' perceptions towards young female candidates presenting with glottal fry.

Research Aims

1.) To determine if employers can identify the presence or absence of glottal fry in the speech of young females.

2.) To determine if employers will demonstrate negative perceptions towards young female candidates with glottal fry.

3.) To determine if employers' perceptions towards a young female candidate with glottal fry will influence her eligibility for hiring.

Hypotheses

1.) It was hypothesized that employers will identify the presence of glottal fry in the speech of the continuous glottal fry candidate when compared to candidate using glottal fry at the end of sentences or the non-glottal fry candidate.

2.) It was hypothesized that employers will present with negative perceptions towards young female candidates with glottal fry compared to a non-glottal fry candidate on the semantic differential scales.

3.) It was hypothesized that employers will be more likely to hire the non-glottal fry candidate than a candidate with glottal fry.

Research Design

This is a survey research utilizing a quantitative descriptive research design. An online survey was utilized to recruit a large number of respondents (i.e., employers) across the Southern United States.

Ethical Considerations

Ethical principles were adhered to in every aspect of the study, including survey development, dissemination, data retrieval, and data analysis. The Institutional Review Board (IRB) at East Tennessee State University (ETSU) reviewed and approved all stages of this research, ensuring adherence to appropriate protocol and practice in human subject research.

Participation in this study was completely voluntary and respondents completed an informed consent form prior to the initiation of the survey. The respondents' confidentiality and privacy regarding their identity and records were protected through the security features of the online survey software, REDCap® (Research Electronic Data Capture). REDCap® is a secure, web-based software platform designed to support data capture for research studies, providing 1) an intuitive interface for validated data capture; 2) audit trials for tracking data manipulation and export procedures; 3) automated export procedures for seamless data downloads to common statistical packages; and 4) procedures for data integration and interoperability with external sources (Harris et al., 2009; Harris et al., 2019). The survey was anonymous, and no IP addresses were collected. The data for this study was extracted from REDCap® via Excel® files.

Materials

Voice Samples

The voice samples were collected from three graduate students in the Department of Audiology and Speech-Language Pathology at East Tennessee State University. All graduate students were sent an email specifying the need for voice samples for the given study. Interested participants were consented to participate in the study and underwent a voice screening protocol utilizing the CAPE-V to ensure eligibility for the study. Participants read six sentences from the Consensus Auditory-Perceptual Evaluation of Voice (CAPE-V), and the PI and faculty advisor rated the voice using the parameters of the CAPE-V (see Appendix A). Based on the results of the CAPE-V, each participant was categorized as one of the following voice types: no glottal fry, glottal fry at the end of sentences, and continuous glottal fry. The voice types (i.e., non-glottal fry, glottal fry at the end of sentences, and continuous glottal fry) were selected based on previous research on the use of glottal fry in varying linguistic contexts (Oliveria et al., 2016; Wolk et al., 2012). The primary investigator recorded all voice samples using the Voice Memos application on a MacBook Pro. The PI ensured a mouth to microphone distance of 30 cm. Participants read the following passage:

> "Hi, I am Kendall, thank you so much for sitting with me today. After graduating with my Bachelor's degree in business management, I have spent the last four years building my professional experience as an executive assistant. I have successfully managed end-to-end event coordination, managed day to day tasks of colleagues including calendar management and organization of business activities. I can bring in my qualifications and strengths to your firm and I am confident that I will be a good fit in the advertised role. I

appreciate you taking the time to meet with me today and providing me an opportunity to interview at your firm. If you have any questions, don't hesitate to contact me. I look forward to hearing from you soon."

In order to eliminate any content bias and maintain consistent information presented across each sample, the three participants recited the same script designed to simulate a portion of an interview. Each participant provided the same information in the voice sample in order to control for the hiring construct of knowledge and skills. All participants used the same name to reduce implicit bias and eliminate confounding variables. The voice sample participants were judged to have neutral dialects by the PI and the faculty advisor. Dialect was controlled to further reduce any bias in the perceptions of vocal qualities other than glottal fry (Heaton & Nygaard, 2001; Preston, 1999;).

Survey Development

A survey was developed to identify employers' attitudes towards young female candidates with glottal fry. The survey was developed following an extensive literature review on research pertaining to glottal fry, its impact on listener perceptions, and hiring constructs. The initial survey was developed using REDCap®secure survey software (see Appendix B).

The survey included an initial screening questionnaire to determine respondent eligibility. The initial screening questionnaire targeted respondent demographics (e.g., gender, age, and ethnicity) and specific eligibility questions (e.g., geographic region and responsibility for hiring). Eligible respondents provided their consent prior to the initiation of the actual survey.

Following consent, respondents were provided with the following instructions: “In the following pages, you will be listening to voice recordings of three candidates for a position at your business or company. Each candidate presents with the same qualifications, job knowledge, and experience for this position. Each candidate will read from the same script. Please rate the candidate regarding your perception of their personality and social skills based on their voice.” The initial instructions were provided to ensure that respondents were rating the candidate solely on their voice.

The survey comprised of three pages, with each page containing (a) the voice sample from each candidate, (b) the semantic differential scales (VAS) consisting of the contrasting adjective sets, and (c) a yes/no question regarding the hirability of each candidate and an open-ended question of why or why not. Following the three pages for each candidate, respondents were asked to select which candidates presented with glottal fry and rank the candidates from most hirable to least hirable. Please see the initial survey (Appendix B) for further details on the semantic differential scales and instructions.

In order to avoid an order effect, three versions of the survey were created. In each type of the survey, the candidates were presented in a different order; however, the questions remained the same for each version. See figure 1 for the order of the candidates in each survey version.

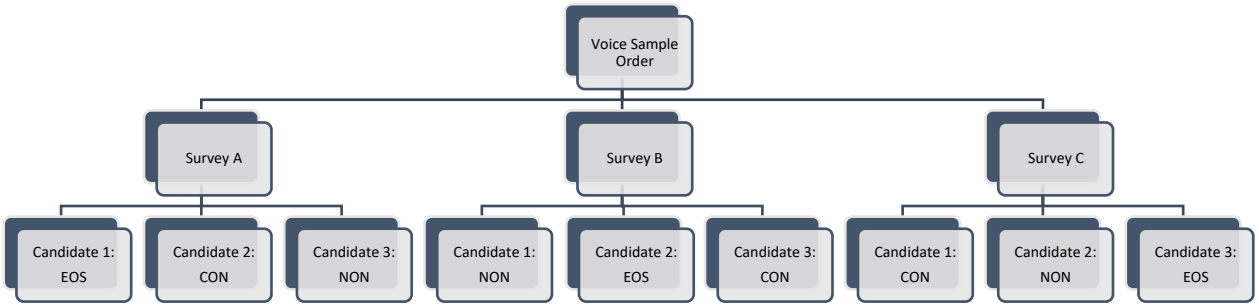

Figure 1. Voice Sample Order per Survey Version

Note: NON= Non-Glottal Fry Sample, EOS= End of Sentences Glottal Fry Sample, CON= Continuous glottal fry sample

Pilot Survey

A pilot survey was sent to 25 contacts of the Department of Marketing and Management at East Tennessee State University. Participants were sent the survey invitation and link via e-mail. The pilot survey aimed to obtain feedback on (a) the length of the survey, (b) the ease of completing the survey, (c) the ease of accessing the voice samples, (d) the clarity of the instructions, (e) the clarity of the questions, and (f) any additional suggestions to improve the survey. Seven individuals responded to the pilot survey invitation. Five individuals completed the entire survey.

For results of the pilot study, refer to table 9. Overall, the results of the pilot study were positive. The respondents indicated that the survey was an appropriate length and easy to complete. The majority of respondents indicated that the instructions and questions were clear. Other suggestions to improve the survey included: (a) placing a neutral marker on the semantic differential scale, (b) reducing the number of semantic differential scales, and (c) rewording the ranking question for clarity.

Table 9

Pilot Study Data (N=5)

Question	Results/Themes		
Was this survey length too long, too short, or about right?	About right- 4	Too Long -1	
How easy was it to complete this survey?	Extremely Easy- 2	Very Easy- 3	
Did you have difficulty accessing the voice samples?	No- 5		
Were the instructions of this survey clear and easy to understand? If not, please provide suggestions.	Instructions were clear- 4	Last question regarding ranking was confusing	
Do any questions need to be reworded? If yes, please explain.	Questions were clear- 4	Ranking question- 1	
Do you have any suggestions to improve this survey?	Desire for neutral marker on the semantic differential scales- 2	Reduce the number of semantic differential scales	Reword the ranking question for clarity

The final survey incorporated the changes from the pilot survey. Specifically, the ranking question was clarified to read as “please rank the candidates from 1 to 3 with 1 being more likely to hire and 3 being lease likely to hire.“ The semantic differential scales were adjusted for the individual to click and capture the neutral position. However, the number of semantic differential scales was maintained at 14 hiring construct pairs in order to appropriately capture

the hiring constructs of mental capabilities, personality tendencies, and applied social skills. Please see Appendix C for the final version of the survey.

Respondents

Target Population

Individuals who are responsible for hiring at their business or company served as the target population to best address the research aims of the current study.

Sampling Method

This study utilized randomized purposeful sampling to recruit the appropriate population to capture the specific aims. (Orlikoff, Schiavetti, & Metz, 2014).

Specific Inclusionary Criteria

The respondents had to be at least 18 years of age, residing in the southern United States, and responsible for hiring at their business or company.

Exclusionary Criteria

Respondents were excluded from participating in the survey if they were younger than 18 years of age, residing in a geographical area other than the southern United States, and were not responsible for hiring at their place of employment.

Procedure

Respondent Recruitment

Potential respondents were identified through Chambers of Commerce, contacts of the Department of Marketing and Management at ETSU, small businesses, Facebook groups, and mall offices. In order to avoid any bias of accent, only employers in the southern United States were recruited to participate in this study.

Business contacts of the Department of Marketing and Management at ETSU and Chambers of Commerce in major cities in Tennessee were contacted via a scripted letter through e-email communication (see Appendix D). Chambers contacted included: Johnson City Chamber of Commerce, Kingsport Chamber of Commerce, Knoxville Chamber of Commerce, Nashville Area Chamber of Commerce, Rutherford County Chamber of Commerce, Chattanooga Area Chamber of Commerce, Clarksville Area Chamber of Commerce, and Greater Memphis Chamber. Due to poor response from the business contacts and Chambers of Commerce, small businesses, Facebook groups aimed at people responsible for hiring (e.g., human resources professionals, small business owners, recruiters, etc.), and mall offices were targeted.

Respondent Description

183 individuals initiated the survey after receiving the initial recruitment letter. Of the individuals who initiated the survey, 60 individuals met the eligibility criteria, provided consent, and completed the survey. Please see figure 2 for the distribution of initiated surveys. In the results section, respondents will be referred to as “employers” to align with the research aims stated. In order to assist with survey completion, respondents were not required to answer all questions. Specifically, respondents were given option to answer the open-ended questions at the end of each candidates page, the identification question, and the ranking question.

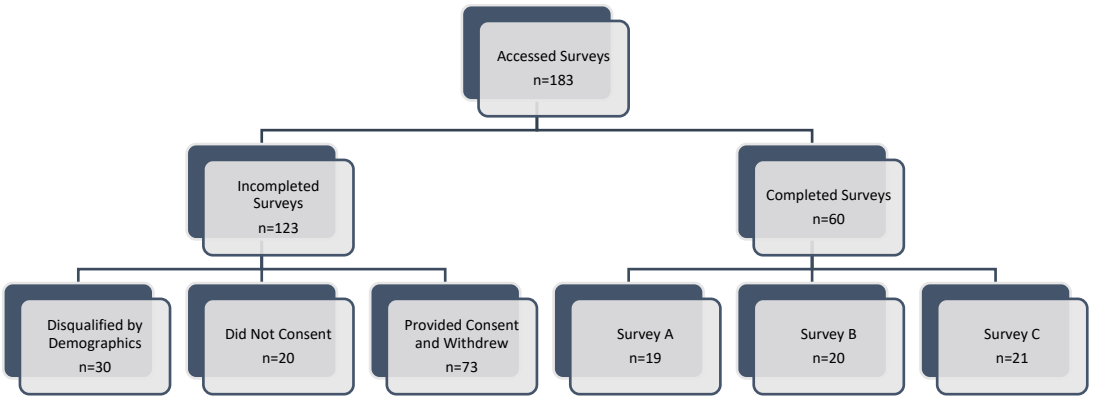

Figure 2. Distribution of Accessed Surveys

Respondent Demographics:

Tables 10, 11, and 12 provide information of the distribution of respondent gender, age, and ethnicity respectively. The respondents were evenly distributed across genders. The majority of respondents were between the ages of 45-64 years and identified as "White/Caucasian."

Table 10

Respondent Demographics-Gender (N=60)

Gender	Number	Percent
Male	30	50%
Female	30	50%

Table 11

Respondent Demographics-Age (N=60)

Age Range	Number	Percent
18-24	1	1.67%
25-34	8	13.33%
35-44	8	13.33%
45-54	21	35.00%
55-64	21	35.00%
65+	1	1.67%

Table 12

Respondent Demographics-Ethnicity (N=60)

Ethnic Group	Number	Percent
American Indian/Alaskan Native	1	1.67%
Asian/Pacific Islander	0	0%
Black/African American	0	0%
Hispanic	1	1.67%
White/Caucasian	55	91.67%
Other	1	1.67%

Data Collection

The secure online survey tool, REDCap®, was used for data collection. REDCap® was selected due to its security features and unique survey features, such as embedded audio-clips.

Respondents followed a link to the online survey uploaded to REDCap®. All responses were recorded for each respondent and available for review and analysis by the primary researcher.

Data Extraction

Data was extracted from REDCap® using Excel file forms. The data was compiled for each survey version and organized by voice type (e.g., non-glottal fry, glottal fry at the end of sentences, and continuous glottal fry). Upon completion of data collection, the data from each survey question was organized by each specific aim for analysis.

Data Analysis

Descriptive and inferential statistics were utilized during data analysis. Specifically, means, standard deviations, and frequency distributions were calculated. Data analysis procedures for each research aim are as follows:

Research Aim 1: In order to analyze the respondents' ability to identify the presence of absence of glottal fry in the voice , a frequency distribution was calculated.

Research Aim 2: A numerical value between 1 and 100 was assigned to each contrasting adjective set of the semantic differential scale. The numerical value was automatically generated by REDCap® based on the respondents' positioning of the sliding scale. The values for each contrasting adjective set were averaged across all participants for each voice type. One-way ANOVA tests were conducted to assess differences in perceptions of employers across the three voice samples (NON, EOS, NON) using IBM SPSS version 25.0 software.

Research Aim 3: Frequency of occurrence of yes or no in the closed ended question for hirability was obtained to identify the impact of glottal fry in the decision of employers. Open-ended questions were analyzed using selective coding methods in which the responses were

coded into main themes (i.e., the hiring constructs) and further categorized into subthemes and analyzed for overall patterns (Orlikoff et al., 2014). Specifically, employers comments were analyzed and categorized according to the hiring constructs (see table 7). After being organized into overall categories, the contrastive adjective sets were further analyzed for positive comments (e.g., enthusiastic) or negative comments (e.g., unenthusiastic). Additionally, frequency of occurrence was determined for “most likely to be hired” and “least likely to be hired.”

CHAPTER 4

RESULTS

Results are presented according to the specific aims of the study using both descriptive and inferential statistics.

Identification of Glottal Fry

Specific Aim 1: To determine if employers can identify the presence or absence of glottal fry in the speech of young females. Frequency distribution of the voice types identified as using glottal fry is represented in table 13.

Table 13

Frequency Distribution of Identification of Glottal Fry (n=57))

Voice Type	Number	Percent
Non-Glottal Fry	3	5.46%
End of Sentences Fry	4	7.02%
Continuous Fry	44	77.19%
End of Sentences Fry and Continuous Fry	5	8.77%
Non-Glottal Fry and End of Sentences Glottal Fry	1	1.75%

Of the 57 participants, approximately 9% identified glottal fry accurately in both the end of sentence glottal fry candidate and continuous glottal fry candidate. Additionally, approximately 86% of employers identified a continuous glottal fry in the speech of young women compared to only 18% identifying glottal fry at the end of sentences. Despite the poor identification of fry at the end of sentences, employers commented negatively on the vocal

quality. Specifically, the employers shared positive comments on the non-glottal fry candidate's vocal quality and negative comments on the candidates' who used glottal fry (see table 14).

Table 14

Employers' Responses Pertaining to Voice Quality

Voice Type	Comments
Non-Glottal Fry (n=56)	"Spoke quicker and with more energy." "Can communicate clearly and naturally." "Look upon this person positively."
End of Sentences Fry (n=56)	"Each statement seemed to *drift away in both tone and substance*" "Just going through the motions." "Sounded competent *but nervous*." "Didn't sound as motivated." "Sounded *lethargic and uninterested*."
Continuous Glottal Fry (n=54)	"Impaired vocal quality is noticeable." "Hard time with voice." "Wouldn't do well on the phone." "Has credentials but needs work on voice." "Hesitant to hire for leadership positions." "Wouldn't rate as high as other candidates." "Rasp might give an edge in business."

Perception of Glottal Fry

Specific Aim 2: To determine if employers will demonstrate negative perceptions towards young female candidate with glottal fry. Results from the semantic differential scales are presented on the distinct categories of the hiring constructs: mental capabilities, applied social skills, and personality tendencies. Descriptive analysis revealed a negative trend towards candidates with glottal fry compared to the non-glottal fry candidate. Specifically, the non-glottal fry candidate was perceived more positively than the candidates who used glottal fry across all constructs assessed. Across most constructs assessed, the candidate using continuous

glottal fry was perceived more negatively than the candidate who used glottal fry at the end of sentences. Figures 3, 4, and 5 illustrate the employers' mean perception of the three candidates on the hiring constructs of mental capabilities, applied social skills and personality tendencies respectively. A one-way ANOVA revealed significant differences between the three groups on the constructs assessed (see table 15).

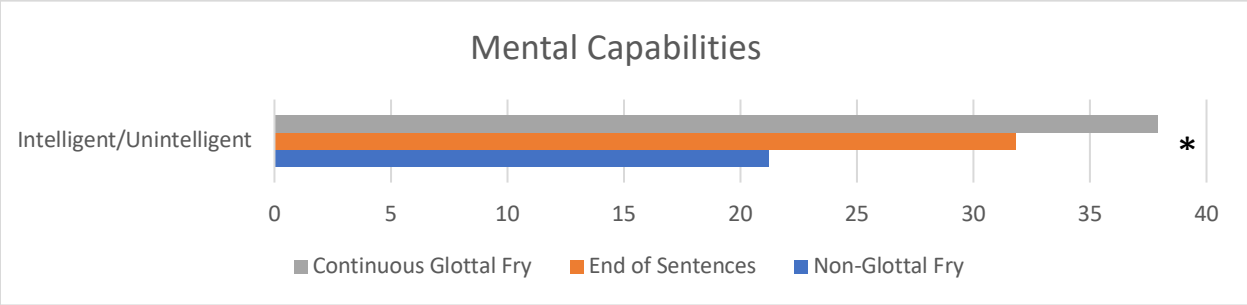

Figure 3. Mean Values of Employer Perceptions on Mental Capabilities (N=60)

Note: An * represents statistical difference.

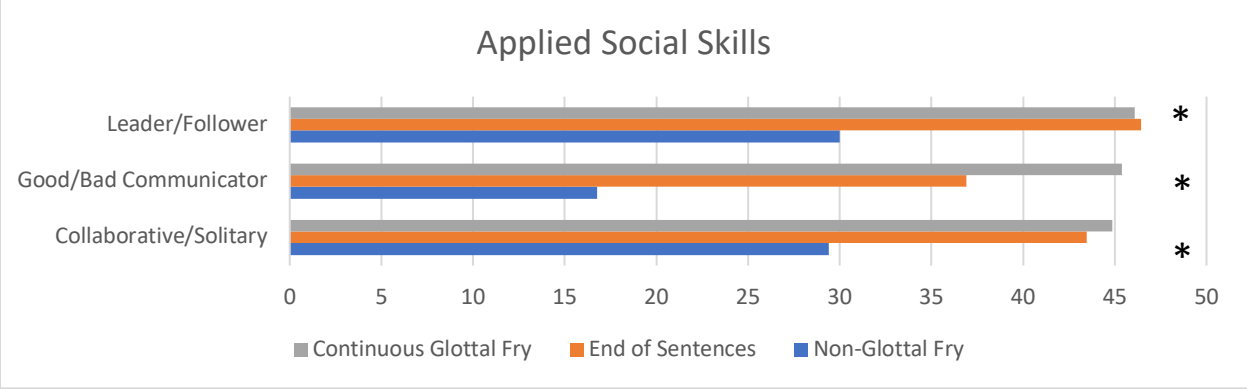

Figure 4. Mean Values of Employer Perceptions on Applied Social Skills (N=60)

Note: An * represents statistical difference.

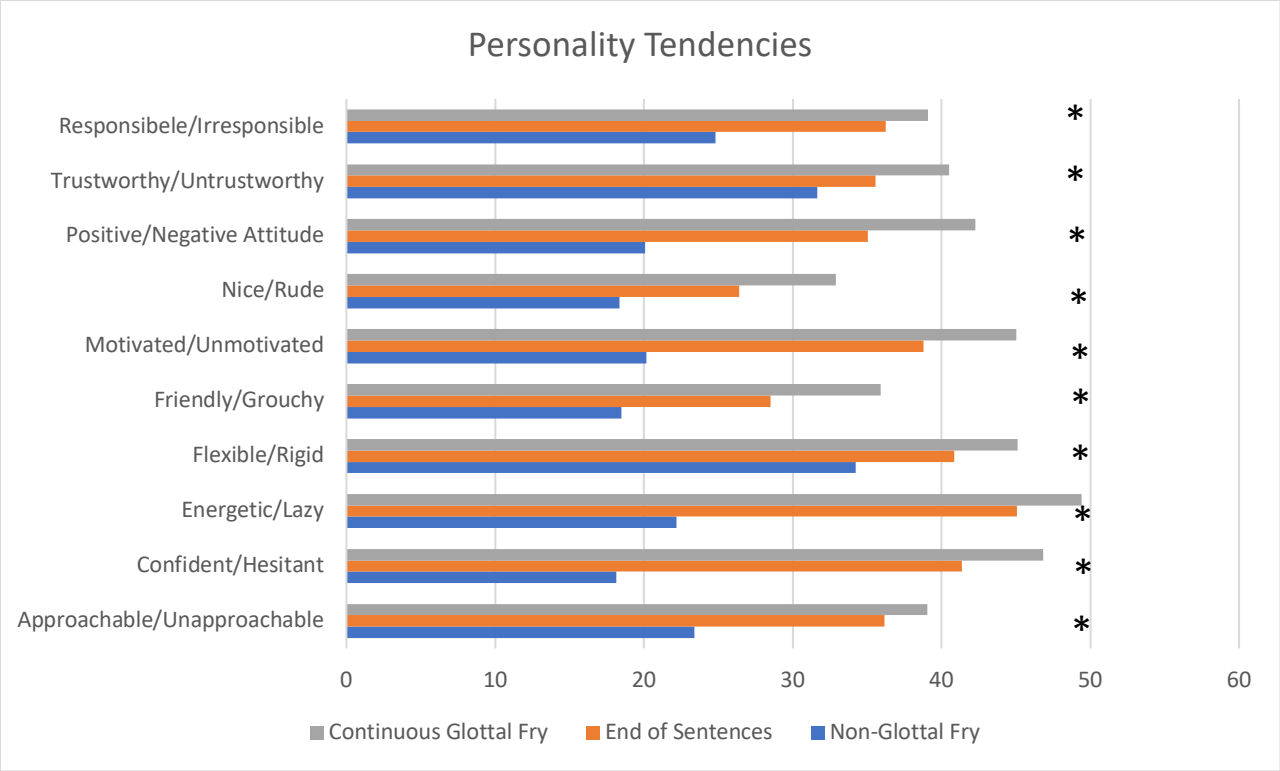

Figure 5. Mean Values of Employer Perceptions on Personality Tendencies (N=60)

Note: An * represents statistical difference.

A post-hoc Bonferroni Correction was conducted to assess the differences between the specific groups (See Table 16). Overall, the non-glottal fry was perceived significantly more positively than the continuous glottal fry across all the hiring constructs. Similar results were observed between non-glottal fry and end of sentences glottal fry on all hiring constructs with the exception of two constructs (i.e., trustworthy and flexible). Interestingly, there were no significant differences between the glottal fry at the end of sentences candidate and the continuous glottal fry candidate except on one construct (i.e., communicator). Employers perceived the continuous glottal fry candidate to be a poor communicator when compared to the glottal fry at the end of sentences candidate.

Table 15

Means and One-Way ANOVA Analysis for Non-Glottal Fry (NON), End of Sentence Glottal Fry (EOS), and Continuous Glottal Fry (CON) for Each Hiring Construct (N=60)

Hiring Constructs	Means			Between Group Analysis	
	NON	EOS	CON	F Value	Significance (p≤.05)
Mental Capabilities					
Intelligent/Unintelligent	21.20	31.85	37.93	14.389	.000*
Applied Social Skills					
Collaborative/Solitary	29.40	43.45	44.85	11.446	.000*
Good /Bad Communicator	16.75	36.90	45.40	36.362	.000*
Leader/Follower	29.98	46.45	46.08	12.716	.000*
Personality Tendencies					
Approachable/Unapproachable	23.38	36.17	39.03	11.096	.000*
Confident/Hesitant	18.15	41.37	46.85	33.971	.000*
Energetic/Lazy	22.20	45.08	49.42	39.358	.000*
Flexible/Rigid	34.23	40.85	45.10	5.477	.005*
Friendly/Grouchy	18.48	28.52	35.93	13.466	.000*
Motivated/Unmotivated	20.18	38.80	45.05	25.372	.000*
Nice/Rude	18.35	26.42	32.90	10.753	.000*
Positive/Negative Attitude	20.10	35.03	42.27	20.435	.000*
Trustworthy/Untrustworthy	31.65	35.55	40.50	4.195	.017*
Responsible/Irresponsible	24.82	36.25	39.08	11.210	.000*

Note: An * represents statistical difference.

Table 16

Means and Bonferroni Correction Significance for Non-Glottal Fry (NON), End of Sentence Glottal Fry (EOS), and Continuous Glottal Fry (CON) for Each Hiring Construct (N=60)

Hiring Constructs	Means			Significance (p≤.05)		
	NON	EOS	CON	NON/EOS	NON/CON	EOS/CON
Mental Capabilities						
Intelligent/Unintelligent	21.20	31.85	37.93	.003*	.000*	.167
Applied Social Skills						
Collaborative/Solitary	29.40	43.45	44.85	.000*	.000*	1.000
Good /Bad Communicator	16.75	36.90	45.40	.000*	.000*	.044*
Leader/Follower	29.98	46.45	46.08	.000*	.000*	1.000
Personality Tendencies						
Approachable/Unapproachable	23.38	36.17	39.03	.001*	.000*	1.000
Confident/Hesitant	18.15	41.37	46.85	.000*	.000*	.419
Energetic/Lazy	22.20	45.08	49.42	.000*	.000*	.517
Flexible/Rigid	34.23	40.85	45.10	.141	.004*	.602
Friendly/Grouchy	18.48	28.52	35.93	.010*	.000*	.088
Motivated/Unmotivated	20.18	38.80	45.05	.000*	.000*	.261
Nice/Rude	18.35	26.42	32.90	.033*	.000*	.122
Positive/Negative Attitude	20.10	35.03	42.27	.000*	.000*	.127
Trustworthy/Untrustworthy	31.65	35.55	40.50	.614	.013*	.323
Responsible/Irresponsible	24.82	36.25	39.08	.001*	.000*	1.000

Note: An * represents statistical difference.

Hirability of Glottal Fry

Specific Aim 3: To determine if employers' perceptions towards a young female candidate with glottal fry will influence her eligibility for hiring. This aim was addressed through a yes/no question at the end of each candidates' page and through the ranking question. See table 17 for the frequency distribution of candidate hirability.

Table 17

Frequency Distribution of Hirability of Candidates (N=60)

Voice Type	Yes		No	
	Number	Percent	Number	Percent
Non-Glottal Fry	57	95.00%	3	5.00%
End of Sentences Fry	42	70.00%	18	30.00%
Continuous Fry	37	61.67%	23	38.33%

Results revealed a negative trend towards candidates who use glottal fry. Employers indicated that they were less likely to hire a candidate using glottal fry than a candidate with a non-glottal fry. Across the two glottal fry candidates, employers were less likely to hire a candidate with a continuous glottal fry.

The employers were also asked to rank the three candidates in order from "most likely to hire" to "least likely to hire." Results from the ranking question further revealed a negative trend between the presence of glottal fry and perceived hirability. Employers indicated that

they were most likely to hire the non-glottal fry voice and the least likely to hire the continuous glottal fry candidate of the three candidates presented (see table 18).

Table 18

Frequency Distribution of Order of Hirability (n=52)

Voice Type	Most Likely		Least Likely	
	Number	Percent	Number	Percent
Non-Glottal Fry	42	80.77%	2	3.85%
End of Sentences Fry	9	17.31%	15	28.85%
Continuous Fry	1	1.92%	34	65.38%

Employers provided open ended answers on the reason for hirability or lack thereof for each of the candidates. Open ended questions were themed and organized into categories based on the hiring constructs (see table 19). Overall, positive responses were observed for the non-glottal fry candidate across all constructs, and the continuous glottal fry candidate was perceived negatively. However, employers had mixed perceptions towards the candidate using glottal fry at the end of sentences. The employers used several contrastive adjectives (e.g., energetic/unenergetic) when describing the candidate using glottal fry at the end of sentences. Employers provided responses regarding the construct of skills and knowledge, in spite of this construct being controlled for during the instructions (See table 19).

Table 19

Open-Ended Questions Themes

Hiring Construct	Non-Glottal Fry (n=56)		End of Sentences (n=56)		Continuous Glottal Fry (n=54)	
	Positive	**Negative**	**Positive**	**Negative**	**Positive**	**Negative**
Mental Capabilities	Intelligent				Intelligent	
Applied Social Skills	Sounded Organic Clear/concise Good communicator Well spoken Good impression Gets message across	Flat affect	Good Communicator Well spoken Controlled voice Articulate Outgoing Presented Well	Flat affect	Clear/Concise Conveyed message	Hard to understand Monotone Slow pace Not well spoken
Personality Tendencies	Confident Energetic Pleasant Interested Open Upbeat Lucid Friendly Assertive Positive Courteous Enthusiastic Has initiative Approachable Genuine	Not personable Not genuine	Energetic Reasonable Positive Attitude Driven/Desire Competent Personable Deliberate Approachable Motivated Confident Organized Genuine Friendly Organized Excited	Lacked Energy Cautious Not creative Nervous Lacked passion Hesitant/Unsure Not genuine Not assertive Not engaged Unmotivated Unenthusiastic Lacked initiative	Nice Sincere Pleasant Eager Positive Attitude Upbeat Hardworking	Unenergetic/Tired Lazy Uncomfortable Uninterested Sick Boring Hesitant Not confident Unenthusiastic Lacked Passion
Knowledge and Skills	Professional Ready Prepared Qualified Good work ethic		Knowledgeable Professional Well prepared Willing to try Qualified		Knowledgeable Professional Qualified Good experience	Unprofessional

CHAPTER 5

DISCUSSION

The purpose of this study was to explore employers' attitudes towards young women using glottal fry and its impact on their perceived hirability. Interpretation of the results are discussed below and are organized according to the specific research aims:

Identification of Glottal Fry

The majority of employers were able to identify fry in the continuous glottal fry candidate. However, the employers were less likely to identify fry in the end of sentences. These results are consistent with prior research on the identification of continuous glottal fry in sustained phonation (Bloomgren et al., 1998). No studies have targeted the identification of fry at the end of sentences in conversation in spite of prior research indicating that glottal fry most frequently occurs at the end of sentences in speech of young Americans (Abdelli-Beruh et al., 2014; Oliveira et al., 2016; Wolk et al., 2012). Prior research has hypothesized that glottal fry at the end of sentences has become an American marker of social status or authority (Anderson et al., 2014; Wolk et al., 2012). The increased prevalence of glottal fry in this linguistic context (i.e., end of sentences) could have resulted in the lack of identification of this vocal quality as glottal fry.

Despite their difficulty in labeling glottal fry at the end of sentences, employers' were able to distinguish a difference in vocal quality between the three voice types. Employers commented negatively on the voice of the glottal fry at the end of sentences candidate (e.g., "drift[s] away in both tone and substance," "sounded nervous," "sounded lethargic and uninterested") but positively commented on the voice of the non-glottal fry candidate(e.g.,

"spoke quicker and with more energy" and "communicate[s] clearly and naturally"). Employers in the present study may have been unaware of the term glottal fry but were able to distinguish a change in vocal quality. The ability of employers to identify a change in vocal quality between the non-glottal fry and glottal fry at the end of sentences candidates support prior literature that glottal fry is an auditory-perceptually distinct vocal quality (Bloomgren et al., 1998).

Employers' Attitudes towards Glottal Fry

Overall, there was a negative trend between employers' perceptions and the presence of glottal fry. Employers judged the voice of non-glottal fry candidate more positively than the voice of the continuous glottal fry candidate across all adjectives assessed. The employers judged the voice of the non-glottal fry candidate more positively than the voice of the glottal fry at the end of sentences candidate on most adjectives assessed. The results of this study are consistent with prior research on the perception of glottal fry, which found that speakers using glottal fry were perceived to be less trustworthy, competent, educated, attractive, and natural than speakers who did not use glottal fry (Anderson et al., 2014; Venkatraman & Sivasankar, 2018). Additionally, prior research has found that listeners perceived glottal fry to require more concentration to attend to and understand the message being conveyed (Venkatraman & Sivasankar, 2018). The increase in cognitive load required to attend to a speaker of glottal fry could contribute to the negative perceptions of speakers of glottal fry.

However, to the best of our knowledge, this is the first study to look at perceptions toward glottal fry with underpinnings from hiring constructs. Existing literature on hiring and interviews have concluded that assessment of individuals on hiring constructs (e.g., mental capabilities, applied social skills, and personality tendencies) are a valid and accurate method of

determining a candidate's disposition and probable performance (Huffcutt et al., 2001; Moregeson et al., 2005; Sackett and Lievens, 2008). Employers perceived the candidates using glottal fry to be more negative on all construct areas assessed. As these constructs are the most frequently assessed during the interview process, it is reasonable to conclude that individuals who present with glottal fry will be rated negatively by employers during a structured interview (Huffcutt et al., 2001).

Interestingly, employers perceived the glottal fry and the end of sentences and continuous glottal fry candidates similarly. This finding is interesting given that the employers were unable to label or identify the voice of the glottal fry at the end of sentences candidate as "glottal fry." There was one exception to this finding, where the employers perceived the glottal fry at end of sentences candidate as a good communicator compared to the continuous glottal fry candidate. Further support to this construct was evidenced through the perceptions in the open-ended questions (e.g., "impaired vocal quality is noticeable," "hesitant to hire for leadership position," and "has credentials but needs work on voice"). Prior literature has hypothesized that listeners' prefer vocal qualities that fit within an expected norm (Anderson et al., 2014). The acoustic, aerodynamic, and physiologic deviations between glottal fry and modal register phonation may have resulted in the similar negative perceptions between continuous glottal fry and glottal fry at the end of sentences.

Hirability of Glottal Fry

The results of this study indicate that the presence of glottal fry negatively impacts a young woman's hirability. Overall, employers indicated that they would hire all three candidates, with a greater likelihood of hiring the non-glottal fry candidate. However, when

asked to rank the candidates from most likely to hire to least likely to hire, employers indicated that they were less likely to hire a candidate that presented with glottal fry (both end of sentence and continuous fry). These findings are consistent with prior research on the hirability of young women using glottal fry (Anderson et al., 2014; Venkatraman & Sivasankar, 2018).

The decreased hirability of speakers of glottal fry is likely related to the employers' negative perceptions towards young women using this vocal quality (Anderson et al., 2014). Interestingly, employers indicated that they were less likely to hire a candidate using glottal fry regardless of describing all candidates as qualified, knowledgeable, and professional. This finding is crucial for young women entering an increasingly competitive job market as their use of glottal fry can hinder their performance during the interview process and negatively impact their chances of getting hired (Anderson et al., 2014).

To summarize, this study reveals a negative trend towards candidates using glottal fry and the impacts on their potential hirability. This current study concurs with existing literature but has tapped on a different methodology to address perceptions. Such differences include (a) utilizing individuals responsible for hiring at their place of employment, (b)utilizing a simulated interview script, and (c) evaluating the candidates using hiring constructs. The results of this study provide meaningful results regarding the impact of hirability of young women using glottal fry related to hiring constructs frequently assessed during the hiring process.

Implications

The implications of this study are multifold providing greater insight into the vocal register of glottal fry, its impact on perceptions, and increasing SLP awareness of glottal fry. Employers perceived candidates using glottal fry more negatively than a candidate without

glottal fry across the three general constructs assessed. Consequently, glottal fry negatively impacts a young woman's chance of being hired. Consistent with prior research, employers were less likely to hire a candidate who used glottal fry compared to a candidate who did not use glottal fry (Anderson et al., 2014; Venkatraman & Sivasankar, 2018). It is crucial for young women to understand the negative impact of glottal fry as they enter the increasingly competitive job market. Moreover, as telephone and internet-based interviews become more prevalent, vocal quality may have a larger impact on perceptions as other factors, such as nonverbal cues, are unavailable or minimized in these interview types (Sackett and Lievens, 2008).

Prior research has hypothesized that females use glottal fry as a feminine marker of authority and dominance, especially in the workforce (Anderson et al., 2014; Wolk et al., 2012; Yussa, 2010). However, the current study found that females using glottal fry were perceived to be less collaborative, less intelligent, less motivated, less confident, less of a leader, and a worse communicator than their peers who do not use glottal fry. These negative perceptions may result in young women who utilize glottal fry to be perceived as less authoritative and dominant by their employer, contradicting prior beliefs on the use of glottal fry (Anderson et al., 2014; Wolk et al., 2012; Yussa, 2010).

Additionally, it is crucial for speech language pathologists (SLPs) to understand the impact of glottal fry. The field of speech language pathology is largely female dominated and prior research has found that fry is becoming a prevalent vocal pattern among SLPs (Glottliebson et al., 2007). The prevalence of this vocal quality (i.e., glottal fry) will not only influence perceptions and perceived hirability of SLPs, but it will also impact therapy delivery

and communication, as glottal fry tends to present with a decreased signal to noise ratio (Bloomgren et al., 1998). Therefore, it is imperative to educate speech language pathologists on the impact of glottal fry both on listener attitudes and their ability to provide quality services to their patients.

Limitations

The current study has some limitations including the sample, length of the survey, and the task used. This study has a sample size of 60 employers with the respondents from the southern United States, primarily White/Caucasian, and primarily between the ages of 45-64. Therefore, the results of the current study may not be a representation of the general population.

Another limitation to the current study is the length and nature of the survey. The survey consisted of five demographic questions, 50 questions pertaining to the candidates, and three voice samples lasting approximately a minute each. The survey required respondents to listen to audio files that were embedded in the survey webpage, which may have been detrimental for completion of the survey (e.g., respondents unable to listen to the audio files due to their environment, respondents not willing to access the audio files due to security, etc.). These could be potential reasons for the increased withdrawal rate of the respondents.

A further limitation to the current study could be the task used. While previous literature has used single sentence stimuli or story reading passages, this study aimed to simulate a structured interview through the use of a simulated interview script (Anderson et al., 2014; Venkatraman & Sivasankar, 2018). However, the simulated interview script utilized in this study is a monologue reading rather than a dialogue that would occur in a face-to-face

interview. The use of a monologue-reading task could have altered other vocal aspects, such as intonation and rate of speech, which would naturally occur in an interview. Regardless of these limitations, this study provided meaningful results and offered insight into perceptions toward young women using glottal fry.

Recommendations for Future Research

The results of this study have both confirmed prior reports on the perceptions of glottal fry and revealed new information regarding employers' perceptions of young women using glottal fry. Employers were able to identify the sample with a continuous glottal fry, however, employers were unable to identify glottal fry at the end of sentences. Future research should explore the characteristics of glottal fry in different contexts and the impact on individuals' ability to identity fry.

Previous research on the perception of glottal fry has found a correlation between age and negative perceptions, with older individuals perceiving glottal fry more negatively than younger individuals (Anderson et al., 2014). Studies utilizing younger participants (e.g., college-aged females) reported positive perceptions of glottal fry, such as more educated and professional (Ligon et al., 2018; Yussa, 2010). Additionally, elementary school children tend to prefer a teacher using glottal fry compared to a teacher using modal phonation (Smith et al., 2018). These positive perceptions toward glottal fry could be attributed to the increased prevalence of this vocal quality in young female speakers (Wolk et al., 2012). Future research should evaluate generational differences in the use and identification of glottal fry and to assess if this vocal quality is becoming a "norm."

Additionally, the current study examined employers' attitudes towards young women using glottal fry in businesses, such as retailers and restaurants. However, there is no known research on the impact of glottal fry in other professions, such as medical professionals and speech language pathologists, in spite of an increase in prevalence in professional voice users (Glottliebson et al., 2007). It is critical to understand the impact of glottal fry on listener attitudes towards individuals in other professions. Specifically, future research should focus on the impact of glottal fry on patient-provider relationships in health care and allied health professions.

While prior research has focused on listeners' perceptions towards glottal fry, only one known study has assessed the physiologic impact of glottal fry and found an increase in perceived vocal effort with continuous glottal fry (Venkatraman & Sivasankar, 2018). In spite of the little evidence, it is hypothesized that glottal fry use can lead to future voice disorders (Glottliebson et al., 2007; Venkatraman & Sivasankar, 2018,). Future research should evaluate the long-term physiologic impact of glottal fry and determine if glottal fry warrants the classification of a voice disorder.

Conclusions

To the best of our knowledge, this is the first study to evaluate employers' perceptions of young women using glottal fry with underpinnings from the hiring construct literature and the impact of these perceptions on their perceived hirability. Our results provide insight in to the negative perceptions toward female speakers with glottal fry and indicate that the use of glottal fry has a detrimental impact on young women's performance during the hiring process, especially in an increasingly competitive job market. An individual's voice conveys important

information on personality traits, applied social skills, mental capabilities and personal appearance. Results from this study can be utilized to increase awareness on the impact of voice on listener perceptions and communication among young female speakers. Finally, this study lays the foundation for future research to understand the role of SLPs in the habilitation of glottal fry, given the increased prevalence of this vocal quality among young female speakers.

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APPENDICES

Appendix A

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

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

Voice Sample #:_____

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.
   b. How hard did he hit him?
   c. We were away a year ago.
   d. We eat eggs every Easter.
   e. My mama makes lemon muffins.
   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

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

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:_____

Appendix B

Initial Survey

Confidential

Perceptions of Glottal Fry

Demographics	
What is your gender?	◯ Female ◯ Male
What is your age range?	◯ Under 18 ◯ 18-24 ◯ 25-34 ◯ 35-44 ◯ 45-54 ◯ 55-64 ◯ 65+
Which race/ethnicity best describes you? (Please choose only one.)	◯ American Indian or Alaskan Native ◯ Asian/Pacific Islander ◯ Black or African American ◯ Hispanic ◯ White/Caucasian ◯ Other
In which region of the United States do you live?	◯ New England (Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut) ◯ Middle Atlantic (New York, New Jersey, Pennsylvania) ◯ East North Central (Ohio, Indiana, Illinois, Michigan, Wisconsin) ◯ West North Central (Minnesota, Iowa, Missouri, North Dakota, South Dakota, Nebraska, Kansas) ◯ South Atlantic (Delaware, Maryland, District of Columbia, Virginia, West Virginia, North Carolina, South Carolina, Georgia, Florida) ◯ East South Central (Kentucky, Tennessee, Alabama, Mississippi) ◯ West South Central (Arkansas, Louisiana, Oklahoma, Texas) ◯ Mountain (Montana, Idaho, Wyoming, Colorado, New Mexico, Arizona, Utah, Nevada) ◯ Pacific (Washington, Oregon, California, Alaska, Hawaii)
Are you responsible for hiring at your place of employment?	◯ Yes ◯ No

Consent Document

Thank you for considering to participate in our survey. Your feedback is important. Please take as long as you need to review the consent document below. If you have any questions, please do not hesitate to contact the primary investigator using the contact information provided in the consent document.

Consent Document:

Dear Participant:

My name is Natalie Foulks, and I am a graduate student at East Tennessee State University. I am working on a Master's thesis in the department of Audiology and Speech Language Pathology. The name of my research study is Listener's Attitudes towards Young Women using Glottal Fry.

The purpose of this study is to determine the impact of glottal fry (e.g., low, creaky, raspy voice) on young women's perception and hireability. I would like to give a brief survey to individuals who are responsible for the hiring employees using REDCap. It should only take about 7-10 minutes to finish. You will be asked questions about your perception of the "candidates" and if you would hire them to work at your company or not.

There are minimal risks for participants enrolled in this study. We will be obtaining minimal information through the demographic information. The survey software we used will not allow for us to disable the collection of IP addresses. However, REDCap does collect IP addresses through their software. Your IP address will not be accessed by the researchers conducting this study and will be protected through REDCap's security standards. While there are no direct benefits to you for participating in this study, your responses will provide information on how glottal fry impacts the perception of young women who use glottal fry as well as their perceived hirability, which will be useful for young women entering the job market and potential employers.

Your confidentiality will be protected as best we can. Since we are using technology no guarantees can be made about the interception of data sent over the Internet by any third parties, just like with emails. REDCap has security features that will be used: secure web connection, multi-factor authentication, and data logging will be used during this study. Although your rights and privacy will be protected, the East Tennessee State University (ETSU) Institutional Review Board (IRB) and people working on this research can view the study records.

No information that can directly identify you will be collected during this study.

Taking part in this study is voluntary. You may decide not to take part in this study. You can quit at any time. If you quit or decide not to take part, the benefits that you would otherwise get will not be changed.

If you have any research-related questions or problems, you may contact me, Natalie Foulks at 423.620.3574 or foulksn@etsu.edu. I am working on this project with my professor, Dr. Chaya Guntupalli. You may reach her at 423.439.4036 nanjundeswar@etsu.edu. Also, you may call the chairperson of the IRB at ETSU/VA at (423) 439-6054 if you have questions about your rights as a research subject. If you have any questions or concerns about the research and want to talk to someone who is not with the research team or if you cannot reach the research team, you may call an IRB Coordinator at 423/439-6055 or 423/439-6002.

Sincerely,
Natalie Foulks

Clicking the I AGREE button below indicates
• I have read the above information
• I agree to volunteer
• I am at least 18 years old
• I am in a position responsible for hiring

◯ I AGREE
◯ I DO NOT AGREE

Welcome

In the following pages, you will be listening to voice recordings of three candidates for a position at your business or company. Each candidate presents with the same qualifications, job knowledge, and experience for this position. Each candidate will read from the same script. Please rate the
candidate regarding your perception of their personality and social skills based on their voice.

Candidate 1

Please listen to the following audio-recording. Please use the provided contrasting adjectives to describe the candidate based on their voice. Slide the bar anywhere on the line to indicate perceived qualities base on the candidate's voice.

[Attachment: "Candidate 1.m4a"]

Is this candidate:
Nice or Rude

Nice — Rude

(Place a mark on the scale above)

Is this candidate:
Friendly or Grouchy

Friendly — Grouchy

(Place a mark on the scale above)

Is this candidate:
Intelligent or Unintelligent

Intelligent — Unintelligent

(Place a mark on the scale above)

Is this candidate:
Trustworthy or Dishonest

Trustworthy — Dishonest

(Place a mark on the scale above)

Is this candidate:
Responsible or Irresponsible

Responsible — Irresponsible

(Place a mark on the scale above)

Is this candidate a:
Leader or Follower

Leader — Follower

(Place a mark on the scale above)

Is this candidate:
Motivated or Unmotivated

Motivated — Unmotivated

(Place a mark on the scale above)

Does this candidate have a:
Positive Attitude or Negative Attitude

Positive Attitude — Negative Attitude

(Place a mark on the scale above)

Is this candidate:
Confident or Hesitant

Confident — Hesitant

(Place a mark on the scale above)

Is this candidate:
Approachable or Unapproachable

Approachable — Unapproachable

(Place a mark on the scale above)

Is this candidate: Collaborative or Solitary	Collaborative — Solitary *(Place a mark on the scale above)*
Is this candidate a: Good Communicator or Bad Communicator	Good Communicator — Bad Communicator *(Place a mark on the scale above)*
Is this candidate: Flexible or Rigid	Flexible — Rigid *(Place a mark on the scale above)*
Is this candidate: Energetic or Lazy	Energetic — Lazy *(Place a mark on the scale above)*
Would you hire this candidate?	○ Yes ○ No
If yes, why would you hire this candidate?	__________________________
If no, why would you not hire this candidate?	__________________________

Candidate 2

Please listen to the following audio-recording. Please use the provided contrasting adjectives to describe the candidate based on their voice. Slide the bar anywhere on the line to indicate perceived qualities base on the candidate's voice.

[Attachment: "Candidate 2.m4a"]

Is this candidate: Nice or Rude	Nice	Rude *(Place a mark on the scale above)*
Is this candidate: Friendly or Grouchy	Friendly	Grouchy *(Place a mark on the scale above)*
Is this candidate: Intelligent or Unintelligent	Intelligent	Unintelligent *(Place a mark on the scale above)*
Is this candidate: Trustworthy or Dishonest	Trustworthy	Dishonest *(Place a mark on the scale above)*
Is this candidate: Responsible or Irresponsible	Responsible	Irresponsible *(Place a mark on the scale above)*
Is this candidate a: Leader or Follower	Leader	Follower *(Place a mark on the scale above)*
Is this candidate: Motivated or Unmotivated	Motivated	Unmotivated *(Place a mark on the scale above)*
Does this candidate have a: Positive Attitude or Negative Attitude	Positive Attitude	Negative Attitude *(Place a mark on the scale above)*
Is this candidate: Confident or Hesitant	Confident	Hesitant *(Place a mark on the scale above)*
Is this candidate: Approachable or Unapproachable	Approachable	Unapproachable *(Place a mark on the scale above)*

Is this candidate: Collaborative or Solitary	Collaborative ——— Solitary *(Place a mark on the scale above)*
Is this candidate a: Good Communicator or Bad Communicator	Good Communicator ——— Bad Communicator *(Place a mark on the scale above)*
Is this candidate: Flexible or Rigid	Flexible ——— Rigid *(Place a mark on the scale above)*
Is this candidate: Energetic or Lazy	Energetic ——— Lazy *(Place a mark on the scale above)*
Would you hire this candidate?	○ Yes ○ No
If yes, why would you hire this candidate?	__________________________________
If no, why would you not hire this candidate?	__________________________________

Candidate 3

Please listen to the following audio-recording. Please use the provided contrasting adjectives to describe the candidate based on their voice. Slide the bar anywhere on the line to indicate perceived qualities base on the candidate's voice.

[Attachment: "Candidate 3.m4a"]

Is this candidate:
Nice or Rude

Nice — Rude

(Place a mark on the scale above)

Is this candidate:
Friendly or Grouchy

Friendly — Grouchy

(Place a mark on the scale above)

Is this candidate:
Intelligent or Unintelligent

Intelligent — Unintelligent

(Place a mark on the scale above)

Is this candidate:
Trustworthy or Dishonest

Trustworthy — Dishonest

(Place a mark on the scale above)

Is this candidate:
Responsible or Irresponsible

Responsible — Irresponsible

(Place a mark on the scale above)

Is this candidate a:
Leader or Follower

Leader — Follower

(Place a mark on the scale above)

Is this candidate:
Motivated or Unmotivated

Motivated — Unmotivated

(Place a mark on the scale above)

Does this candidate have a:
Positive Attitude or Negative Attitude

Positive Attitude — Negative Attitude

(Place a mark on the scale above)

Is this candidate:
Confident or Hesitant

Confident — Hesitant

(Place a mark on the scale above)

Is this candidate:
Approachable or Unapproachable

Approachable — Unapproachable

(Place a mark on the scale above)

Is this candidate: Collaborative or Solitary	Collaborative — Solitary *(Place a mark on the scale above)*
Is this candidate a: Good Communicator or Bad Communicator	Good Communicator — Bad Communicator *(Place a mark on the scale above)*
Is this candidate: Flexible or Rigid	Flexible — Rigid *(Place a mark on the scale above)*
Is this candidate: Energetic or Lazy	Energetic — Lazy *(Place a mark on the scale above)*
Would you hire this candidate?	◯ Yes ◯ No
If yes, why would you hire this candidate?	______________________
If no, why would you not hire this candidate?	______________________

Please rank the candidates with 1 being most likely to hire and 3 being least likely to hire.

_____

Appendix C

Final Survey

Confidential

Perceptions of Glottal Fry

Demographics	
What is your gender?	◯ Female ◯ Male
What is your age range?	◯ Under 18 ◯ 18-24 ◯ 25-34 ◯ 35-44 ◯ 45-54 ◯ 55-64 ◯ 65+
Which race/ethnicity best describes you? (Please choose only one.)	◯ American Indian or Alaskan Native ◯ Asian/Pacific Islander ◯ Black or African American ◯ Hispanic ◯ White/Caucasian ◯ Other
In which region of the United States do you live?	◯ New England (Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut) ◯ Middle Atlantic (New York, New Jersey, Pennsylvania) ◯ East North Central (Ohio, Indiana, Illinois, Michigan, Wisconsin) ◯ West North Central (Minnesota, Iowa, Missouri, North Dakota, South Dakota, Nebraska, Kansas) ◯ South Atlantic (Delaware, Maryland, District of Columbia, Virginia, West Virginia, North Carolina, South Carolina, Georgia, Florida) ◯ East South Central (Kentucky, Tennessee, Alabama, Mississippi) ◯ West South Central (Arkansas, Louisiana, Oklahoma, Texas) ◯ Mountain (Montana, Idaho, Wyoming, Colorado, New Mexico, Arizona, Utah, Nevada) ◯ Pacific (Washington, Oregon, California, Alaska, Hawaii)
Are you responsible for hiring at your place of employment?	◯ Yes ◯ No

Consent Document

Thank you for considering to participate in our survey. Your feedback is important. Please take as long as you need to review the consent document below. If you have any questions, please do not hesitate to contact the primary investigator using the contact information provided in the consent document.

Consent Document:

Dear Participant:

My name is Natalie Foulks, and I am a graduate student at East Tennessee State University. I am working on a Master's thesis in the department of Audiology and Speech Language Pathology. The name of my research study is Listener's Attitudes towards Young Women using Glottal Fry.

The purpose of this study is to determine the impact of glottal fry (e.g., low, creaky, raspy voice) on young women's perception and hireability. I would like to give a brief survey to individuals who are responsible for the hiring employees using REDCap. It should only take about 7-10 minutes to finish. You will be asked questions about your perception of the "candidates" and if you would hire them to work at your company or not.

There are minimal risks for participants enrolled in this study. We will be obtaining minimal information through the demographic information. The survey software we used will not allow for us to disable the collection of IP addresses. However, REDCap does collect IP addresses through their software. Your IP address will not be accessed by the researchers conducting this study and will be protected through REDCap's security standards. While there are no direct benefits to you for participating in this study, your responses will provide information on how glottal fry impacts the perception of young women who use glottal fry as well as their perceived hirability, which will be useful for young women entering the job market and potential employers.

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Taking part in this study is voluntary. You may decide not to take part in this study. You can quit at any time. If you quit or decide not to take part, the benefits that you would otherwise get will not be changed.

If you have any research-related questions or problems, you may contact me, Natalie Foulks at 423.620.3574 or foulksn@etsu.edu. I am working on this project with my professor, Dr. Chaya Guntupalli. You may reach her at 423.439.4036 nanjundeswar@etsu.edu. Also, you may call the chairperson of the IRB at ETSU/VA at (423) 439-6054 if you have questions about your rights as a research subject. If you have any questions or concerns about the research and want to talk to someone who is not with the research team or if you cannot reach the research team, you may call an IRB Coordinator at 423/439-6055 or 423/439-6002.

Sincerely,
Natalie Foulks

Clicking the I AGREE button below indicates
• I have read the above information
• I agree to volunteer
• I am at least 18 years old
• I am in a position responsible for hiring

◯ I AGREE
◯ I DO NOT AGREE

Welcome

In the following pages, you will be listening to voice recordings of three candidates for a position at your business or company. Each candidate presents with the same qualifications, job knowledge, and experience for this position. Each candidate will read from the same script. Please rate the
candidate regarding your perception of their personality and social skills based on their voice.

Candidate 1

Please listen to the following audio-recording. Please use the provided contrasting adjectives to describe the candidate based on their voice. Slide the bar anywhere on the line to indicate perceived qualities base on the candidate's voice.

[Attachment: "Candidate 1.m4a"]

Is this candidate:
Nice or Rude

Nice — Rude

(Place a mark on the scale above)

Is this candidate:
Friendly or Grouchy

Friendly — Grouchy

(Place a mark on the scale above)

Is this candidate:
Intelligent or Unintelligent

Intelligent — Unintelligent

(Place a mark on the scale above)

Is this candidate:
Trustworthy or Dishonest

Trustworthy — Dishonest

(Place a mark on the scale above)

Is this candidate:
Responsible or Irresponsible

Responsible — Irresponsible

(Place a mark on the scale above)

Is this candidate a:
Leader or Follower

Leader — Follower

(Place a mark on the scale above)

Is this candidate:
Motivated or Unmotivated

Motivated — Unmotivated

(Place a mark on the scale above)

Does this candidate have a:
Positive Attitude or Negative Attitude

Positive Attitude — Negative Attitude

(Place a mark on the scale above)

Is this candidate:
Confident or Hesitant

Confident — Hesitant

(Place a mark on the scale above)

Is this candidate:
Approachable or Unapproachable

Approachable — Unapproachable

(Place a mark on the scale above)

Is this candidate: Collaborative or Solitary	Collaborative — Solitary *(Place a mark on the scale above)*
Is this candidate a: Good Communicator or Bad Communicator	Good Communicator — Bad Communicator *(Place a mark on the scale above)*
Is this candidate: Flexible or Rigid	Flexible — Rigid *(Place a mark on the scale above)*
Is this candidate: Energetic or Lazy	Energetic — Lazy *(Place a mark on the scale above)*
Would you hire this candidate?	○ Yes ○ No
If yes, why would you hire this candidate?	______________________
If no, why would you not hire this candidate?	______________________

Candidate 2

Please listen to the following audio-recording. Please use the provided contrasting adjectives to describe the candidate based on their voice. Slide the bar anywhere on the line to indicate perceived qualities base on the candidate's voice.

[Attachment: "Candidate 2.m4a"]

Is this candidate: Nice or Rude	Nice	Rude *(Place a mark on the scale above)*
Is this candidate: Friendly or Grouchy	Friendly	Grouchy *(Place a mark on the scale above)*
Is this candidate: Intelligent or Unintelligent	Intelligent	Unintelligent *(Place a mark on the scale above)*
Is this candidate: Trustworthy or Dishonest	Trustworthy	Dishonest *(Place a mark on the scale above)*
Is this candidate: Responsible or Irresponsible	Responsible	Irresponsible *(Place a mark on the scale above)*
Is this candidate a: Leader or Follower	Leader	Follower *(Place a mark on the scale above)*
Is this candidate: Motivated or Unmotivated	Motivated	Unmotivated *(Place a mark on the scale above)*
Does this candidate have a: Positive Attitude or Negative Attitude	Positive Attitude	Negative Attitude *(Place a mark on the scale above)*
Is this candidate: Confident or Hesitant	Confident	Hesitant *(Place a mark on the scale above)*
Is this candidate: Approachable or Unapproachable	Approachable	Unapproachable *(Place a mark on the scale above)*

Is this candidate: Collaborative or Solitary	Collaborative ——— Solitary *(Place a mark on the scale above)*
Is this candidate a: Good Communicator or Bad Communicator	Good Communicator ——— Bad Communicator *(Place a mark on the scale above)*
Is this candidate: Flexible or Rigid	Flexible ——— Rigid *(Place a mark on the scale above)*
Is this candidate: Energetic or Lazy	Energetic ——— Lazy *(Place a mark on the scale above)*
Would you hire this candidate?	◯ Yes ◯ No
If yes, why would you hire this candidate?	__________________
If no, why would you not hire this candidate?	__________________

Candidate 3

Please listen to the following audio-recording. Please use the provided contrasting adjectives to describe the candidate based on their voice. Slide the bar anywhere on the line to indicate perceived qualities base on the candidate's voice.

[Attachment: "Candidate 3.m4a"]

Is this candidate:
Nice or Rude

Nice — Rude

(Place a mark on the scale above)

Is this candidate:
Friendly or Grouchy

Friendly — Grouchy

(Place a mark on the scale above)

Is this candidate:
Intelligent or Unintelligent

Intelligent — Unintelligent

(Place a mark on the scale above)

Is this candidate:
Trustworthy or Dishonest

Trustworthy — Dishonest

(Place a mark on the scale above)

Is this candidate:
Responsible or Irresponsible

Responsible — Irresponsible

(Place a mark on the scale above)

Is this candidate a:
Leader or Follower

Leader — Follower

(Place a mark on the scale above)

Is this candidate:
Motivated or Unmotivated

Motivated — Unmotivated

(Place a mark on the scale above)

Does this candidate have a:
Positive Attitude or Negative Attitude

Positive Attitude — Negative Attitude

(Place a mark on the scale above)

Is this candidate:
Confident or Hesitant

Confident — Hesitant

(Place a mark on the scale above)

Is this candidate:
Approachable or Unapproachable

Approachable — Unapproachable

(Place a mark on the scale above)

Is this candidate: Collaborative or Solitary	Collaborative — Solitary *(Place a mark on the scale above)*
Is this candidate a: Good Communicator or Bad Communicator	Good Communicator — Bad Communicator *(Place a mark on the scale above)*
Is this candidate: Flexible or Rigid	Flexible — Rigid *(Place a mark on the scale above)*
Is this candidate: Energetic or Lazy	Energetic — Lazy *(Place a mark on the scale above)*
Would you hire this candidate?	◯ Yes ◯ No
If yes, why would you hire this candidate?	_____
If no, why would you not hire this candidate?	_____

Please answer the following questions based on the three candidates' voices. Short samples of each candidate have been provided if needed.	
Candidate 1 [Attachment: "Candidate 1.m4a"]	
Candidate 2 [Attachment: "Candidate 2.m4a"]	
Candidate 3 [Attachment: "Candidate 3.m4a"]	
Please rank the candidates from 1 to 3 with 1 being most likely to hire and 3 being least likely to hire.	_____
Please select which candidate(s) use glottal fry.	☐ Candidate 1 ☐ Candidate 2 ☐ Candidate 3

Appendix D

Scripted Recruitment Letter

Hello, my name is Natalie Foulks. I am a graduate student in the department of Audiology and Speech Language Pathology at East Tennessee State University (ETSU). I am doing a study that involves determining the perceptions and hireability of young women who use glottal fry (e.g., a low, creaky, raspy voice). I am looking for people who are responsible for hiring at businesses. This study involves the completion of a survey, which should take about 7-10 minutes. The survey will take place online. I would appreciate your consideration in participating in my study. Participation is completely voluntary.

If you wish to participate in this study, please click on the link below to begin. If you click on the link, you will to directed to a demographic questionnaire to determine your eligibility to participate in this study. If you qualify to participate, you will then be directed to the consent document. If you choose to consent to participate, you will then be directed to the survey. If you do not qualify for the survey or do not wish to participate, you will be removed from the survey.

If you do not wish to participate in this study, there is no further action needed from you at this time. If you have any questions, please contact me at foulksn@etsu.edu.

To complete the survey, please follow the link here:
https://etsuredcap.etsu.edu/surveys/?s=3DTAM7X4YK

If you are interested in participating, please complete the survey by February 15th, 2019.

Sincerely,

Natalie Foulks

VITA

NATALIE BREANNE FOULKS

Education: M.S. Speech-Language Pathology, East Tennessee State University, Johnson City, Tennessee, 2020

B.S. Speech-Language Pathology, Middle Tennessee State University, Johnson City, Tennessee, 2018

Professional Experience: Graduate Assistant, East Tennessee State University, College of Clinical and Rehabilitative Health Sciences, 2018-2020

Publications: Foulks, N., Nanjundeswaran, C., van Mersbergen, M., Louw, B., and Gorman., C. A. (2020). Listeners Attitudes toward Young Women using Glottal Fry. Oral session presented at the Voice Foundation Annual Symposium, Philadelphia, PA.

Nanjundeswaran, C., Ballone, H., Farris, A., Foulks, N., and Richardson, S.(2019). Listener Attitudes toward Teachers with Voice Problems. Oral session presented at the Fall Voice Conference, Dallas, TX.

Ballone, H., Farris, A., Foulks, N., Richardson, S., and Nanjundeswaran, C. (2019). Listener Attitudes toward Teachers with Voice Problems. Poster session presented at the Appalachian Student Research Forum, Johnson City, TN.

Foulks, N. and Blankenship, K. (2017). Listener Attitudes toward Teachers with Voice Problems. Poster session presented at the American Speech Language and Hearing Association Annual Convention, Los Angeles, CA.

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