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THE EFFECT OF PITCH HEIGHT ON INSTRUMENT GENDER RATINGS

A Thesis

Presented for the

Master of Music – Music Education

Degree

The University of Mississippi

Raven Gordon Thompson

May 2022

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ABSTRACT

The purpose of this study was to examine the effect of pitch height on instrument gender ratings. This study's participants ($N=64$) consisted of music major ($n=32$) and non-music major ($n=32$) students who are enrolled at the University of Mississippi. Using a 5-point semantic rating scale, participants rated the perceived masculinity and femininity of six musical instruments (flute, clarinet, saxophone, trumpet, trombone, tuba) as they are played at the approximate midpoint of their ranges and as they played in ranges that countered their established instrument-sex-stereotype. Specifically, female instruments (flute, clarinet) played in their low ranges while male instruments (trombone, tuba) played in their high ranges. Instruments with unclear or neutral gender ratings (trumpet, saxophone), played in both extremes of their ranges. Once the data were collected, participants' ratings of the instruments were compared using the Wilcoxon signed rank test. This statistical analysis revealed that pitch height had a significant effect on music majors' perceived gender ratings for the flute and the trumpet performing at the lower extremes of their ranges. The analysis also revealed that pitch height had a significant effect on non-music majors' perceptions of all instruments except the tuba and the saxophone in its low range. The Mann-Whitney test determined that the only instruments music majors and non-music majors rated significantly different were the trumpet in its high range and the trombone at the midpoint of its range. There was no evidence to support a difference between the ratings of any of the listening examples as a function of participant sex.

Keywords: instruments, gender associations, pitch, auditory perception

DEDICATION

This work is lovingly dedicated to my husband, Ty. Without your tireless encouragement and wicked excel skills I would have given up long ago.

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CHAPTER ONE

INTRODUCTION

Instrument-sex-stereotyping has intrigued music education researchers since they noticed parents, musicians, and children as young as three to five years old all exhibit the behavior (Abeles, 1978). Since then, they have spent much time investigating why instrument stereotyping is so prevalent and how to provide effective treatment. This stereotyping, which constitutes the assignment of genders to instruments and the subsequent formation of stereotypes regarding which instruments are appropriate for the sexes, has led to many problems for music programs around the world.

For the work of this study, it is important to clearly understand the difference between an individual's sex and gender. Sex, whose delineating terms are male and female, simply refers to the categorization of humans according to their reproductive functions (Merriam-Webster, n.d.-c). Gender, whose delineating terms are masculine and feminine, refers to the socially constructed characteristics of women, men, girls and boys (World Health Organization, n.d.). Unlike sex, an individual's gender is defined by their own, personal conception of their social characteristics. Based on the definitions of sex and gender, it becomes clear that the social constructs surrounding each of these concepts are not always as simple as they seem to be. Sex and gender are important in the grand scheme of what it means to be human, but there is much that can be lost when these notions of perceived masculinity and femininity become associated with inanimate musical instruments.

In her work, Doubleday (2008) states “gendered meanings are constructed within relationships between humans and musical instruments” (p. 3) and, as a result, issues regarding sexual orientation and instrument choice have come to effect students (Doubleday, 2008). Because instruments have come to be associated with the gender of its performer, a special problem exists for transgendered individuals, who typically choose to play instruments that belong to their adoptive gender rather than their sex (Doubleday, 2008). The problem is that students who cross the instrument-sex-stereotype are more likely to be bullied by their peers and feel alienated in their music programs (Abeles et al., 2014; Sinsbaugh, 2005; Taylor, 2009). Beyond creating problems for transgender students, the instrument-sex-stereotyping behavior can also create problems for entire music programs. These problems can range from the large-scale issues of instrumentation (Kelly, 1993; Tarnowski, 1993) to the localized issue of instrument over-population, which affects the real and perceived contributions of the individual to the group’s overall achievement (Byo, 1991). In extremely isolated and uncommon instances, the instrument-sex-stereotyping behavior even effects how teachers evaluate their students’ musical performances (Elliot, 1995).

While there seems to be no scientific explanation of why we assign genders to musical instruments, there is a general consensus that these highly prevalent instrument-sex-stereotypes (Bullerjahn et al., 2016) affect instrument preferences and attitudes on musician gender (Wrape et al., 2016). In her qualitative investigation of an all-girls school, Buttu (2008) showed that confidence and success can be unlocked if students who break stereotypes feel safe in their music-making environment. Further, she states that only environments with supportive role models and accepting peers can enable these students to reach their highest level of musicianship.

It is this possibility of helping students reach their highest musical potential that keeps the need for research in this field alive. In their 1979 work, Porter and Abeles state, “music ought to provide the kind of freedom that all adults and children are seeking regardless of sex. (49)” So many aspects of life require us to fit the role that is assigned to us. Music does not need to do this; it needs us to be able to freely express ourselves.

Purpose of Study

The purpose of the current study is to determine if the gender rating of an instrument can be altered by changing the range in which instrument demonstrations occur. The hope is that findings from this study lead to a long-lasting treatment that effectively counters the instrument-sex-stereotyping behavior.

Research Questions

1. Will masculine instruments be rated as less masculine if male instruments play in a higher range?
2. Will feminine instruments be rated as less feminine if female instruments play in a lower range?
3. Are music majors less likely to perceive a change in an instrument’s gender rating than non-music majors?
4. Are female participants more likely to perceive a change in an instrument’s gender rating than male participants?

Definition of Terms

Feminine: characteristic of, appropriate to, or unique to women (Merriam-Webster, n.d.-a)

Gender: socially constructed characteristics of women and men (World Health Organization, n.d.-b)

Masculine: having qualities appropriate to or usually associated with men (Merriam-Webster, n.d.)

Sex: the categorization of humans on the basis of their reproductive functions (Merriam-Webster, n.d.-c)

Timbre: quality of auditory sensations produced by the tone of a sound wave; timbre varies with the number of overtones that are present, their frequencies, and their relative intensities (Encyclopedia Britannica, n.d.)

CHAPTER TWO

REVIEW OF LITERATURE

The Prevalence

Overall, there is a plethora of literature in the field of music education research. The main questions that this literature review seeks to answer are (a) how did the instrument-sex-stereotyping behavior come into existence and (b) how does it maintain such a prevalent role in musical processes, especially with regards to instrument selection? To answer these questions, this review of literature will first examine the instrument-sex-stereotyping behavior and how it effects student's preferences for musical instruments. Then, it will discuss how this behavior effects long-term musical success and perception. A final section will examine how researchers have attempted to modify the behavior.

The Instrument-Sex-Stereotyping Behavior

From the beginning of the history of the topic, there was much debate and research regarding whether or not instrument-sex-stereotypes actually existed. The first substantial study that proved the existence of the stereotyping behavior was conducted by Abeles and Porter in 1978. The work was a four-fold effort that had the ultimate goal of investigating instrument-sex-stereotyping in adults and children, as well as investigating the possible causes for the behavior. During Study 1, adults were given surveys and asked which instrument they would encourage their hypothetical son or daughter to play. Respondents preferred clarinet, flute, and violin for their daughters while drums, trombone, and trumpet were ideal for their sons. Study 2 asked

music majors and non-music majors to place eight instruments on a masculine to feminine continuum. At the end of this study, it was found that flute, clarinet, and violin were most feminine while trombone, trumpet, and drums were most masculine; both music majors and non-music majors gave similar responses. Study 3 surveyed students aged kindergarten through third grade about their instrument preferences. Researchers found that sex, age, and grade level had the greatest effect on which instruments students selected, not administrator sex or range of performance. The final study in this experiment surveyed three- to five-year-old daycare students about their instrument preferences and investigated if the sex of the person demonstrating the instrument affected the children's selections. The study found that young girls were not affected by sex associated presentation, i.e., females playing feminine instruments and males playing masculine instruments. However, young boys responded differently in unbiased presentation, i.e., females playing masculine instruments and males playing feminine instruments (Abeles & Porter, 1978). These studies were monumental in that they suggested the instrument-sex-stereotyping behavior was widespread and could be remedied if instruments were initially presented in a purposeful manner.

While the Abeles and Porter study seemed to provide tangible answers regarding the existence of instrument gender stereotypes, information gathered by other researchers began to counter Abeles and Porter's (1978) findings and began to provide a more holistic understanding of the problem. In 1981, Griswold and Chrobak found results similar to Abeles and Porter (1978), but their research revealed a difference in how music majors and non-music majors rated instruments. Specifically, the researchers found that music majors rated clarinet and string bass more masculine than non-majors. This suggested that involvement in music did, in fact, influence how the genders of musical instruments were rated.

The next significant research on the instrument-sex-stereotyping behavior surfaced when Delzell and Leppala (1992) concluded that the stereotyping had lessened since Abeles and Porter's 1978 investigation. Delzell and Leppala's (1992) work implied that continued sensitivity to issues related to gender and stereotyping could result in the continued reduction of bias. Interestingly, their findings did not explain the processes that led to the lessening of the instrument-sex-behavior.

Two years later, Zervoudakes and Tanur (1994) articulated why the trend in the sex-stereotyping of instruments seemed to be lessening. The researchers found that there was an increase of female students playing male instruments in younger grades, but this was not statistically significant because college and high school band programs were both seeing an increase in the number of female participants. A closer investigation of the numbers revealed an increase in females playing female instruments but no increase in female students playing male instruments. Zervoudakes and Tanur attributed this increase in female participation to the rise of feminism and the increased participation of women in the workforce.

Despite this initial disagreement regarding the severity of and origin of the instrument-sex-stereotyping behavior, the common consensus since the early 2000's has been that these stereotyping behaviors exist and they can have devastating effects on students' music education. One of the latest studies that aimed to examine these stereotyping behaviors was carried out by Abeles et al. (2009). The results indicated that middle school students continue to report instrument-sex-associations in similar ways as previous studies, some of which were conducted 31 years prior.

While there is no clear understanding of the origin of these stereotyping behaviors, Harrison and O'Neill (2002) cite the social influences of parents, teachers, peers, and the media

as sources of information for children about appropriate sex-typed behavior. They state that once a child understands the categories of gendered instruments in music, they seem to be resistant to change (145-146).

Students' Biased Preferences

The first study that made the connection between instrument-sex-stereotyping and preference occurred in 1993. In their study, Fortney et al. (1993) investigated what middle school band students reported to be influences in the instrument selection process. The results showed differences in student responses according to sex and instruments. When asked which instrument they would prefer to play at will, females generally preferred to play the flute or clarinet whereas males preferred to play brass or percussion instruments. When students were asked which instrument they least preferred, there was a notable sex difference in response, with male students making up more than 80% of those least preferring the flute. The researchers found that, regardless of how students responded to questions about the influence of various factors, male students seemed to prefer masculine instruments and female students seemed to prefer feminine instruments (Fortney et al., 1993).

Three years later, O'Neill and Boultona (1996) investigated children's preferences for learning to play musical instruments and the extent to which those preferences were based on instrument-sex-stereotype associations. In individual interviews, 153 children were shown pictures of instruments then asked which one they wanted to play and why that instrument was their first and last choice. They were also asked if they thought the opposite sex should or should not play an instrument. The data collected suggested that children had similar and pronounced ideas about which instruments should be avoided by each sex. Further, most participants believed that their most preferred instrument should not be played by the opposite sex.

Sinsel et al.'s (1997) investigation of the relationship between children's psychological sex type and their most preferred and least preferred instruments provided support for the idea that students have strong ideas about the sex appropriateness of certain instruments. To determine their psychological sex, students took the Children's Sex Role Theory Inventory (CSRI), then listened to recordings of nine instruments (flute, clarinet, oboe, saxophone, horn, trumpet, trombone, tuba, and drums) and completed a musical interest preference survey. Results indicated that androgynous children preferred neutral instruments over sex-typed instruments while sex-typed children seemed committed to selecting instruments appropriate for their sex.

A qualitative study carried out by Conway in 2000 further confirmed the observation that students tend to select instruments they think are appropriate for their own gender. During the study, whose purpose was to understand how high school students perceive, understand, and reflect on why they chose the instruments they played, most students mentioned gender without being prompted to do so.

In 2005, Sheldon and Price examined whether the sex-instrumentation distributions that were prevalent in the United States and England were representative of a larger trend by collecting data from 8,146 community and youth band participants in 25 countries. Directors were asked to complete forms indicating each band member's first name, sex, and instrument. Researchers found a trend towards proportionately more females performing on flute, oboe, and clarinet while more males performed on trumpet, trombone, euphonium, tuba, and percussion. This suggested that students, worldwide, tend to choose instruments that match their sex.

In the same year, Graham (2005) conducted research to investigate reasons for initial instrument choice as a function of participant sex, perceived sex-associations of musical instruments, and instrument transfer. For this study, 235 college musicians (both music majors

and non-music majors) took a survey to rate the influence of factors in the selection process. Then they rated sixteen band and orchestra instruments according to perceived sex-associations. While the results confirmed that instrument-sex-stereotyping is a trend that continues to be observed, the results also confirmed that both male and female participants considered the established sex-stereotype of the instruments in their initial selection of an instrument.

In 2008, Hallam et al. conducted a study to explore whether sex-associated preferences continued during a time where there was gender equality in most aspects of life in the United Kingdom. Using data gathered from a survey and information provided from music services regarding student's biological sex, the researchers found marked gender preferences for some musical instruments, such as harp, flute, oboe, clarinet, violin, trombone, bass guitar, tuba, and drums, still existed (Hallam et al., 2008).

The last major study that examined students' preferences for musical instruments was completed in 2012. Wiedenfeld (2012) examined the views of beginning band students and their parents to determine if their opinions of music and gender affected the instrument selection process. In the student survey, students were asked who helped pick their top three instruments, then asked why they selected each instrument. The final student question, which was open-ended, asked if the student would refuse to join band if they had to play a specific instrument and why they would refuse to play this instrument. The parent survey asked for a history of the family's formal music background, then asked the parents a series of questions about their child's personality to gauge the child's sex-role. The results of this study revealed that fifth graders select their instruments based on social perceptions and that the sex-role of the student was often reflected in their instrument selection (Wiedenfeld, 2012).

The Need

An examination of the literature suggests that there are two major areas of instrumental music that are negatively affected by the instrument-sex-stereotyping behavior. The first area is that of the instrument selection process. The second area, and possibly the most destructive of the two, is that of student perception of peers and the tendency to assign characteristics associated with the instrument to the musician.

The Instrument Selection Process

During the process of instrument selection, there are many factors that interact with one another, and these interactions eventually lead to children's selection of an instrument to play. As one can imagine, the instrument a child chooses to play affects the size of the organization, the instrumentation of said organization, and, most importantly the child's individual success (Wych, 2012). Teachers generally all want to achieve balanced instrumentation while also taking student instrument choice and availability into consideration (Bayley 2004, 23).

With so much of the instrument selection process determining the livelihood of a music program, it is clear that directors have major responsibilities to both their programs and their students. In 2004, Bayley conducted a study about the process that teachers use to prepare students for the instrument selection process. Using a researcher-designed questionnaire, 249 music directors answered open-ended questions about how they approach the instrument selection process. Over 60% of the teachers indicated that they took steps to address sex-stereotyping during the instrument selection process (Bayley, 2004). This study proved teachers saw a need to actively show students that the sex-stereotyping behavior has no impact on which instrument a student will find the most success.

While the results of Bayley's (2004) investigation imply that teachers do not let the sex-

stereotyping of instruments affect their recommendations for which instruments students should choose, the work of Johnson & Stewart (2005) aimed to find data to scientifically confirm these implications. In their study, 204 preservice music educators and higher education music teachers took one of two online questionnaires to investigate the effect of sex and race identification on the assignment of instruments to beginning band students. To provide a means of comparison, participants were randomly assigned to the “face” or “mouth” group. Participants in the face group saw the student’s entire face while participants in the mouth group saw cropped pictures that only showed the student’s mouth area. Results indicated that the ability to identify the sex and race of the student had no significant effect on which instrument students were assigned. Further, comments left by participants confirmed that most directors make instrument assignments based on (1) student interests, (2) physical interests, (3) student counseling, (4) student trials on the instruments, and (5) instrumentation needs (Johnson & Stewart, 2005). From this investigation, it was clear that director bias towards the sex-stereotyping of instruments did not seem to be a significant factor in the instrument selection process.

In a study aimed to examine the instrument selection process, Millian (2017) stated many directors feel students’ progress faster and have more success when they are matched to an instrument that fits their anatomy. Possible markers to future student success on an instrument include (a) lip size, shape, and embouchure, (b) tooth size, distribution, and alignment, (c) body build, (d) hand size and finger size, (e) coordination and motor skill, (f) musical predictors, (g) aural skills, (h) musical aptitude, (i) instrument timbre, and (j) students’ preference for high or low sounds. Non-musical factors include (a) personality and interaction with timbre factors, (b) academic achievement, (c) environmental factors, such as family music background, (d) student motivation, and (e) sex-associations and stereotypes.

Unlike the other musical and non-musical factors, Millican (2017) suggested that sex-associations seemed to have a significant influence on students' selections and, ultimately, prevented students from selecting instruments they might enjoy because students felt as though the instrument was not suitable for their gender. Further, the selection of an instrument that was not suitable to the student's anatomy led to a musical experience that had many obstacles and, in some cases, felt completely unnatural (Millican, 2017). Hurdles as large as these, when compounded with the common struggles of learning a musical instrument, often lead a student to feel defeated and discouraged. The subsequent loss of student motivation often drives the student to quit band all together. In cases such as these, both the student and the music program lose.

Musician Perception

Many studies have explored the phenomenology of assigning genders to instruments and these studies have led to the identification of variables that affect the human perception of an instrument's gender and, by extension, that of the individual playing the instrument. The first major study involving instrument-sex-stereotyping and perception of the musician emerged in an investigation carried out by Cramer et al. in 2002. The goal of the investigation was to evaluate participants' perceptions of hypothetical musicians and the social perception of the instruments they played. The results found that musicians who played a feminine instrument were judged as more caring, sensitive, warm, and better adjusted than musicians who played masculine instruments. Further, female musicians were judged to be more dominant, active and stronger leaders than male musicians. When participants were asked which instrument they thought the respective sex should play, female musicians were permitted to select from a broad spectrum of instruments, while males were permitted to select only from the set of masculine instruments. For both sexes, stepping outside of these conventions resulted in less than favorable impressions

(Cramer et al., 2002). Overall, these findings outline the social perceptions children have of their peers that are based on the instruments they choose. The findings also help educators understand the biases children face in their choice of a musical instrument.

In a study with young children, Marshall and Shibazaki (2011) completed a study that focused on musical sensitivity. While this study aimed to expand upon issues of stylistic discrimination in young children, it also explored associations between musical styles and types of people. The results suggested that even three-year-old children were able to make socially accurate discriminations between musical style but also suggested that a number of “person-type” and sex-associations already appeared to be present in the attitude and experiences of the young participants (Marshall & Shibazaki, 2011).

While the association of “person-type” with musical styles was not exclusive to their hypothesis, Marshall and Shibazaki (2011) decided to explore the issue. In this unexpected experimental tangent, children listened to a musical example, then were asked to select a picture of the person “who likes to listen to this music and who likes this music.” When the female biker was unexpectedly paired with romantic music, the researchers realized the sex of the person in the picture played a larger role than what the person was doing or how they looked. The most relevant finding of this study lies in the fact that the researchers could not confirm whether or not the participants were categorizing according to the sex-association of the dominant instrument or the dominant musical style (Marshall & Shibazaki, 2011)

The unexpected findings in their 2011 study resulted in a new study by Marshall and Shibazaki in 2012. This new study focused on the developing association between the performer’s sex and musical instruments in young children. For this study, participants “played a game” where they matched 14 musical examples with photographs of individuals who might

play the instrument. The results suggested that prominent sex-stereotypes for some instruments exist at a young age while, for other instruments, sex-associations appear to also be linked to the musical style in which they are presented (Marshall & Shibazaki, 2012). Both of these studies by Marshall & Shibazaki suggest that, even from a young age, simply hearing an instrument play starts the process of developing the listener's perception of the musician's sex and personality.

Students Who Cross Instrument-Sex-Stereotypes

As one can imagine, this idea of students imagining the instrument as an extension of themselves and their peers becomes problematic when students choose an instrument whose sex-association counters the student's perception of their own gender. Since the 2000s, studies aimed at understanding and supporting the musician who crosses instrument gender stereotyped have begun to provide a holistic understanding of the challenges these students face as a result of their instrument choices. Sinsbaugh's (2005) case study of twelve students who crossed instrument-sex-stereotypes in the instrument selection process gave researchers a first glimpse. During the study, students were interviewed and observed according to a pre-planned interview guide. Findings indicated that the students faced gender issues as a result of their instrument selection. Specifically, boys seemed to struggle more than girls when they crossed instrument-sex-stereotypes.

Even more light was shed on the issues boys faced when Taylor (2009) conducted a study to examine the experiences and social support structures that contributed to instrument choice and achievement amongst successful male flutists. Participants in the study were seventeen flutists and one piccolo player who participated in Texas Allstate bands and orchestras between 2003 and 2007. The researcher conducted one-on-one Skype interviews with each participant and asked sixteen questions in a semi-structured format. Once all interviews were conducted,

they were transcribed and coded, then participants checked their transcripts to ensure the interview accurately reflected their thoughts and experiences. The results revealed that most participants were teased because the flute is a “girl instrument” but the teasing stopped as they began earning high chair placements in local and regional contests. Further, most flutists cited parent support, private lessons, and teacher support as having major impacts on their success (Taylor, 2009). This study, being the first of its kind, opened the door for other researchers to begin investigating how students who cross instrument-sex-stereotypes cope with the everyday challenges of playing an instrument that most of the other students do not think is suitable for them.

In 2014, Abeles et al. conducted a qualitative study that examined the effect of computer mediated communication (CMCs) on musicians who play instruments that contradict instrument-sex-associations. The data revealed six themes regarding how the student used CMCs. They were: (a) to provide mutual support, (b) to seek out role models, (c) to highlight the relationship between physical appearance and playing a specific instrument, (d) to comment on musician’s gender, and (e) to debate sexual orientation issues related to instrument choice. In the discussion, Abeles et al. (2014) concluded that the internet can be a supportive place, as well as a place that replicates classroom harassment, for students who cross instrument gender stereotypes.

Overall, these studies highlight the need for a treatment for preestablished gender associations of instruments because both musicians and listeners increasingly view the musician’s selected instrument as an extension of the musician.

In a 1998 study, Legette aimed to determine the causes that elementary and secondary public-school students most attribute to success or failure in music. 1,114 elementary, middle, and high school students from vocal, instrumental, and general music classes were asked to

indicate how important they thought each item was to success in their music classes on scale of one to five, with one being not important at all and five being extremely important. Results indicated that students tend to place more importance on ability and effort as attributions for success or failure in music class. In the work, Legette states “student beliefs about what causes their success or failure at a particular task will influence how they approach that task in the future. Success due to ability promotes a sense of pride, whereas failure due to ability promotes a sense of shame” (109). This study on student perceptions of success in music class, when paired with the musician who crosses instrument sex-associations, highlights the need for affective and lasting treatment of instrument sex-stereotyping. The possibility of students feeling as though they failed to perform well on their instrument because the instrument is not suitable for their sex could have catastrophic effects on confidence and self-esteem. Music-making and selecting an instrument should not and does not have to be another source of student duress. The freeing of musical instruments from established sex-associations could create an environment that is inclusive and accepting of all musicians, regardless of which musical instrument they play.

Modifying the Stereotyping Behavior

Since researchers have reached a general consensus that instrument-sex-stereotyping behaviors exist and effect preference and musician perception, much of the recent research regarding the behavior focuses on determining how to effectively provide treatment through the use of demonstrator gender and through the alteration of instrument timbre.

Demonstrator Sex

The earliest intervention studies began in the early 1990’s when Byo (1991) laid the groundwork for studies geared towards modifying the instrument-sex-stereotyping behavior. The purpose of this pioneer study was to test the effect of biased instrument demonstration on

instrument preferences of third grade children. In the study, seventy-six children were introduced to flute, clarinet, saxophone, trumpet, horn, trombone and snare in an unbiased manner. After they learned about these instruments, they took a pre-test to rank the instruments in the order of which they would like to play them. Seven weeks later, the students were divided into three groups and received biased demonstrations. Group one received demonstrations that were biased in favor of the clarinet, group two received demonstrations that placed equal time and stress on all of the instruments, and group three, which functioned as the control group, received demonstrations with verbal descriptions and photographs of the instruments. After their demonstrations, each group took a post-test that asked them, once again, to rank the instruments in the order of which they would like to play them. This investigation's findings indicated that student preference before treatment was similar across all groups while the post-test rankings showed no agreement amongst group rankings (Byo, 1991). Although the treatment did not yield a greater favor for the clarinet or a predictable change across other instruments, change in student preference did occur and that, alone, implied that educators could offset the instrument-sex-stereotypes that children bring to class.

In 1993, Tarnowski conducted a multi-fold study whose purpose was to expand researchers' understanding of instrument-sex-associations and preference by examining (a) when associations develop and the attitudes of children in grades K-2 regarding preference, (b) the influence of parents, educators, and other authority figures on the development of preference in the musical selection process, and (c) the effects of gender-neutral presentation on instrument-sex-associations and preference. The results of this study revealed that instrument-sex-associations with certain instruments continue to exist in groups of elementary children and, of all authority groups, preservice teachers most frequently made sex-based associations. These

findings also indicated that, while the manner in which the instruments were presented and demonstrated led young children to view some of the previously associated instruments as gender neutral, certain instruments continued to be associated with a specific sex (Tarnowski, 1993). This major development in the field began a ripple-effect of investigative studies on the reversal of instrument-sex-stereotypes.

The next major intervention study was carried out by Harrison & O'Neill in 2000. Similar to Tarnowski's investigation in 1993, the Harrison and O'Neill (2000) study investigated the influence of counter-stereotypic roles on children's gender-typed preferences for piano, trumpet, violin, drums, guitar, and flute. This study's treatment featured demonstration concerts at two clusters of schools; one of the clusters received sex consistent performers, while the other cluster received sex inconsistent performers. The results revealed that children show less preference for same-sex instruments when they are played by the opposite sex. Specifically, female students showed less preference for the flute when it was demonstrated by a male performer (Harrison & O'Neill, 2000). This study provided validation for previous findings on this method of treatment because its more detailed investigation measured the students' preferences both before and immediately after the demonstration concerts.

The next year, 2001, Pickering and Repacholi carried out a two-fold study that modified the procedure used in Harrison and O'Neill's (2000) study. In their study, Harrison and O'Neill allowed the performers to choose their own musical selections, meaning that each instrument demonstrated with performer-selected works. As a result, it is believed that the music that was performed affected the children's preferences. In their modified study, Pickering and Repacholi (2001) had all instruments play the same musical selection. Further, this modified study presented instruments in the absence of peers to eliminate the chance of students choosing an

instrument because their friend chose it. The final modification was the use of high school performers in pre-recorded video tapes. The researchers chose to use high school performers because it was believed that children would be more responsive to adolescent demonstrators than adult demonstrators. The results of this modified study showed that children in the counter-stereotypical condition were less likely to select a sex-typed instrument that matched their own sex, while exposure to musicians playing sex-consistent instruments did not increase the rate of sex-typed responses. For their study, providing students with counter-stereotypical examples proved successful but it was unclear why (Pickering & Repacholi, 2001). A decade would go by before the topic was revisited by researchers.

In 2011, Killian & Satrom removed the first link in the chain of successful demonstrator effect concerts by providing treatment concerts that contained either all male or all female demonstrators. This study revealed that boys who viewed male demonstrators chose more brass instruments while girls who viewed female demonstrators chose more woodwind instruments. Both boys and girls who saw opposite-sex demonstrators picked brass and woodwind instruments in nearly equal numbers. Because the results of this study were not statistically significant, the results provided a strong contradiction to nearly all of the other intervention studies involving the effect of demonstrator sex on instrument selection (Killian & Satrom, 2011).

Another study surfaced in 2015 when Vickers examined the effect of demonstrator sex on instrument preferences of beginning band students during the instrument selection process. This study was unique because, unlike those before it, it focused on students at the exact time they are selecting their instruments. For this investigation, 171 students from five schools took a pretest to provide demographic information and to rate their preference for six instruments (trumpet,

drums, saxophone, flute, clarinet, and trombone), with 1 being no desire and 5 being strong desire. Students were then divided into four treatment groups; group one received a female demonstrator, group 2 received a male demonstrator, group three received sex-consistent demonstrators, and group four received sex-inconsistent demonstrators. The results of the study indicated that students preferred instruments along typical sex-stereotypes during the pretest and, while some changes did happen, demonstrator sex had no effect on the students' preferences during the post-test. This study was significant because it marks the beginning of the decline of the belief that demonstrator sex can be used to counter children's preferences for instruments that align with their sex.

In 2016, Bullerjahn and Hoffman completed a replication study of Harrison and O'Neill's (2000) investigation. For this version of the study, ninety German children, aged four- to six-years old, were placed into one of three groups. Like the earlier investigation, children in group one received a gender consistent intervention concert, children in group two received a gender inconsistent intervention concert, and children in group three functioned as the control. Results of this replication study showed that students chose instruments in ways consistent with the established instrument-sex-stereotypes in the first phase and that intervention concerts had no significant effect on the children's preferences (Bullerjahn & Hoffman, 2016).

The most recent study regarding the effect of demonstrator sex, now known as stereotype priming, was conducted by Cooper and Burns in 2019. This study included the traditional band and orchestra instruments and popular music instruments and roles (back-up singer, bass guitar player, DJ/electronic musician, drummer, electric guitar player, keyboard player, rapper, rock star, and singer). Findings indicated that students continued to perceive each band and orchestra instrument to have a gender. Interestingly, findings also indicated that students who violated

stereotypes with their instrument choice had no conception of instrument gender to begin with. In terms of the effect of demonstrator sex, findings showed that when female students saw adult women in every role, they only chose stereotypic roles 53.8% of the time while male students, when presented with females in every role, chose a stereotypic instrument or role 92% of the time. The findings indicated that male students may have experienced stereotype threat, which is a situational predicament that causes the participant to conform to negative stereotypes because the participant has been reminded of the existing stereotypes (Cooper & Burns, 2019). This research suggested that educators may be able to influence their classrooms by creating a more gender-inclusive environment that encourages participation of all sexes. However, findings also suggested that the problem can only be remedied when teachers are highly methodological and provide interventions that are appropriate and effective for both male and female students. Because of the recent up-surge in the number of researchers who report demonstrator sex has no tangible effect on the instrument-sex-stereotyping behavior, more research is needed before the confirmation or rejection can be made permanent.

Timbre

The most recent studies in the literature aim to provide treatment of the stereotyping behavior through the manipulation of instrument timbre. This avenue of research found its origin in a 1997 study involving third graders. In the study, 261 third graders listened to a six-minute cassette recording of typical band and orchestra instruments (flute, clarinet, saxophone, trumpet, trombone, violin, and cello) performing “Lightly Row” and “Good King Wenceslas.” It is important to note that students never physically saw the instruments during this study. Findings indicated that the instrument timbres, alone, affected the instruments’ perceived gender ratings. Implications suggested that, by the end of the third grade, children have established perceptions

of who should play which instrument, even when the instruments are not named and in the absence of visual cues (Kelly, 1997).

While the Kelly (2003) study only mentions timbre on a lucky whim, other investigations have further secured timbre as a determining factor in children's preference for sex-typed instruments. In Katzenmoyer's (2003) descriptive study, 1,073 students in grades five through nine completed surveys where they were asked to describe factors that influenced their musical instrument selection. Contrary to the other literature that lists gender as a determining factor, the most frequently occurring reason for students wanting to learn how to play an instrument was "sound." Additionally, when students were asked to indicate which instrument they would least like to learn to play and to list their reason, "sound" was also the most frequently occurring response. Both of these findings suggest that the sound of the instrument is one of the most important aspects in the instrument selection process (Katzenmoyer, 2003).

To further establish timbre as a variable in the sex-stereotyping of musical instruments, Ziv et al. (2013) conducted a two-fold study to (1) examine whether non-musicians hold the same stereotypes of instrumentalists as musicians and (2) to examine whether hearing a melody in different instrumental timbres influences trait attribution to the assumed performers. For this study, eighty participants rated fictional musicians after hearing the same melody played in three timbres. The results revealed the strong effect of hearing instruments' timbre on trait attribution. While the effects were different for each instrument, non-musicians hearing a melody in three timbres led to ratings in the direction of instrument-sex-stereotypes. Specifically, trumpet was found to be rated in more masculine attributes (assertiveness, extraversion) while the flute was found to be rated in more feminine attributes (introverted, shy, more passive). Overall, this study's findings suggest that stereotypes in music instruments are not solely the result of

acculturation and social influences; it is also in the sound (Ziv et al., 2013).

In 2017, Stronsick et al. conducted a study to determine whether pitch level, timbre, or both have an effect on the perceived gender of instruments. During the investigation, participants were asked to listen to musical examples created at the midpoint of each instrument's range, think about the degree to which they perceived the instrument as masculine, feminine, or neutral, then click on a point between M (masculine) and F (feminine) along a rating bar. Results of the study showed that gender associations are cued by both pitch level and timbre together. It is assumed that, due to the nature of the investigation, that participants did not consider pitch and timbre separately (Stronsick et. al., 2017).

Since the findings of Stronsick et. al.'s (2017) investigation suggest pitch and timbre work together, more research is needed to determine to what degree these two aspects individually cue gender associations. The following pilot study, which was completed as a semester project for a course during the spring semester of the 2020-2021 school year, lays the ground work for the current study. Research questions for the pilot study were:

1. Will the gender association of masculine instruments be rated as less masculine if male instruments play in a higher range?
2. Will the gender association of feminine instruments be rated as less feminine if female instruments play in a lower range?

Pilot Study

In this study, 64 members of the Ole Miss Band, aged 18-25 years old, were randomly assigned to either the control ($n=34$) or experimental group ($n=30$). Participants were asked to listen to short listening examples that were performed using Garritan Instrument for Finale sound units. The control survey consisted of examples performed within the approximate midpoint of

each instrument's range while the experimental survey consisted of listening examples that countered the instrument's established gender rating. Specifically, female instruments (flute, clarinet) included listening examples that covered the instruments' low range while male instruments (trombone, tuba) included listening examples that covered the instrument's high range. For the trumpet and saxophone, whose genders are typically considered neutral or unclear, two listening examples were included in the survey; one covered the instrument's high range while the other covered the instrument's low range. Results indicated that the juxtaposition of established gender association and an opposing performance range produced a change in mean gender ratings (Gordon, 2021).

As a result of the time constraints of a semester long class, I made a conscious decision to include different participants in the control and experimental groups. Because of this, the data from this pilot study does not present a clear picture of the effect of pitch height on instrument gender ratings. The current study aims to provide a more thorough investigation by utilizing a survey instrument that allows participants to function as their own control. Further, the current study will provide a more appropriate analysis of the data by using tests that are suitable for ordinal data.

CHAPTER THREE

METHODOLOGY

The instrument-sex-stereotyping behavior is a phenomenon that researchers have investigated since the late 1970's. The need to develop a treatment for this behavior lies in the fact that this behavior has the power to negatively affect the instrument selection process. Apart from this, research shows that the assignment of genders to instruments also affects how the performer is perceived by their audience before they even play a single note. Finally, the most need for this research lies in the fact that this behavior negatively affects those students who select an instrument that does not match their sex.

Participants

The current study utilized participants ($N = 64$) that were both music majors ($n = 32$) and non-music majors ($n = 32$) at the University of Mississippi. Non-music major participants were required to have less than two years of a formal music education to participate in the experiment. For this study, a formal music education was defined as participation in band, choir, orchestra, or music lessons.

All participants, both music and non-music majors, were recruited via email. Participants who were music majors received a recruitment email that was forwarded to all music students by the music department secretary. To recruit non-music major participants, the researcher applied for and received a random student panel sample from the University of Mississippi's Office of Institutional Research, Effectiveness, and Planning. The student panel sample included email address, classification, race, and major for 5,000 students who attended the University of

Mississippi. While it was ideal that each group consisted of an even number of male and female participants, it was not necessary for the completion of this research project.

Listening Examples

This experiment's listening examples were played on the flute, clarinet, alto saxophone, trumpet, trombone, and tuba. These instruments were selected because they are generally accepted by researchers as having very strong gender associations; the flute and clarinet represent feminine instruments, the trombone and tuba represent masculine instruments, and the alto saxophone and trumpet represent instruments with neutral gender associations.

Listening examples were made up of short, randomly generated nine-note sequences that were played at a moderate tempo with normal articulation, no vibrato, and no dynamic contrast. This mode of performance was used because it prevented the participants from basing their gender ratings on specific musical styles.

Like the pilot study, the control listening examples consisted of short excerpts that were performed within the approximate midpoint of each instrument's playable range. The experimental listening examples consisted of excerpts played within a range that countered the instruments' established gender rating. Specifically, female instruments (flute, clarinet) included listening examples played within their low range while male instruments (trombone, tuba) included listening examples played within their high range. The trumpet and saxophone, whose genders are typically considered neutral or unclear, included two listening examples that covered both their high and low ranges. See Table 1 for an explanation of each instrument's performance range.

Table 1*Performance Ranges of Each Instrument*

Instrument	Accepted Range	Control Range	Experimental Range(s)
Flute	B3-F7	G#5-E6	B3-G3
Clarinet	D3-Bb6	Ab4-F5	Eb3-D4
Saxophone	Db3-A5	A3-G4	F2-G3 A4-G5
Trumpet	E3-Bb5	Eb4-Ab4	Eb3-Ab3 E5-Bb5
Trombone	E2-F5	D3-A3	C4-G5
Tuba	D1-F4	Bb1-G#2	B2-G#3

Unlike the pilot study, all listening examples for the current study were recorded live. It is believed that the use of live performances provided more realistic listening examples which, in turn gave a more realistic understanding of how pitch height affects instruments' gender ratings. Performers of the listening examples were selected from members of the wind ensemble at the University of Mississippi. All recordings utilized the same location and audio equipment to keep the sound quality as consistent as possible. See Appendix B for musical notation of all listening examples.

Survey Instrument and Design

Surveys were distributed using *Qualtrics^{XM}*. This medium was used because it offered the quickest and most efficient method to reach participants. Further, an electronically disseminated survey offered participants freedom to take their survey at the most convenient time. See Appendix A for the survey instrument.

Instead of assigning participants to either the control group or the experimental group, all participants heard all listening examples within the same, single survey. While it is unconventional for the experimental survey to be completed at the same time that the control

survey, this method was chosen to prevent participants from having to commit to a second test. The benefits of obtaining a holistic view of the effect of pitch height on individual instrument gender ratings outweighed the unconventionality of not having a period between the administration of the control and experimental surveys.

After participants listened to each recording, they rated the instruments' perceived gender rating along a 5-point semantic differential scale. The scale anchors were firmly male and firmly female with unclear as the midpoint. The 5-point scale was used because it provided three extremely clear anchors with intermediate ratings of slightly male and slightly female that did not overcomplicate the task by offering too many choices.

Procedure

One survey was developed for all participants. Once participants opened the link for their survey, they were immediately asked to provide their informed consent to participate in the study and determine whether they met the age requirement of being between the ages of 18 and 25.

Once the participants gave their consent to participate in the study and verified that they met the age requirement, the survey collected demographic information. Each participant was asked to specify their sex and major. Branching was used to help ensure all non-music majors had not participated in band, choir, orchestra, or music lessons for more than two years. The final demographic question asked all participants to disclose their sex.

After the first section was completed, participants entered the second section of the survey. During the second section, participants listened to the control listening examples and immediately rated them. While the order of the listening examples was randomized, the control listening examples appeared in this order on the survey: tuba, clarinet, alto saxophone, trumpet, flute, and trombone. To ensure all examples were played, participants were not be able to input

their ratings until the listening example finished playing. Once all the control examples were rated, section three began.

Section three of the survey was formatted the same as section two, except it contained the experimental listening examples. Like section two, the order of the listening examples was randomized and the experimental listening examples appeared in this order: flute, trumpet (low range), alto saxophone (high range), trombone, tuba, alto saxophone (low range), trumpet (high range), and clarinet. Once participants completed their surveys, they were thanked for their time.

Limitations

With the alteration of playing range, there was a chance that some instruments, particularly those that usually play extremely low and extremely high, could be mistaken for another instrument when they perform outside of their generally accepted ranges. To offset the possibility of this type of instrument misidentification, which could affect the perceived gender ratings, listening examples did not include pitches that went above or below the generally accepted playing range of each instrument. Another limitation occurred within the sample. Because all participants for the study will be pooled from the University of Mississippi, the results of this study are not generalizable for a larger, more diverse population.

CHAPTER FOUR

FINDINGS

For this study, participants ($N = 64$) were asked to listen to short playing examples, then, using a 5-point semantic rating scale, rate their perception of each instrument's gender. Because each participant functioned as their own control, all participants completed both the control and the experimental survey. The control survey contained listening examples of each instrument performing at the approximate midpoint of their range while the experimental survey contained listening examples that countered the established instrument-sex-stereotype.

Results

Since the data collected were non-parametric, the Friedman Test was used to evaluate those instruments that had dependent measures for three conditions (saxophone and trumpet) and the Wilcoxon signed rank test was used for instruments that had matched pairs. The Mann-Whitney test was used to compare independent samples for each listening example. For the next section, the 5-point semantic rating scale corresponds with the following 5-point number scale: 1 = firmly male, 2 = slightly male, 3 = unclear, 4 = slightly female, and 5 = firmly female.

Music Majors

The flute's ratings were compared after participants listened to it perform at the midpoint of its range and in the lower extreme of its range. On average, the flute was rated less feminine when it played at the lower extreme of its range ($Mdn = 4$) than when it played at the midpoint of its range ($Mdn = 4.5$). A Wilcoxon signed-rank test indicated that this difference was statistically significant, $T = 140$, $z = 2.26$, $p = 0.024$.

For the trumpet, a Friedman’s test showed that there was a significant difference between the trumpet’s ratings at the midpoint, low, and high ranges, $\chi^2_r(2) = 6.3, p = 0.043$. Post hoc tests using a Wilcoxon signed-rank test showed that the trumpet was rated as more masculine when it played at the lower extreme of its range ($Mdn = 2$) than when it played at the midpoint of its range ($Mdn = 2$). This change in its perceived gender was statistically significant, $T = 156, z = 2.7, p = 0.0069$.

There were no significant differences found for music majors’ perceptions of the clarinet, trombone, and tuba as these instruments performed in a range that countered the instruments’ established instrument-sex-stereotype. See Table 2 for a summary of music majors’ mode (f) perceptions of each instrument’s gender ratings.

Table 2

Music Major’s Mode (f) Perceptions of Each Instrument’s Gender

Instrument	Control Rating (f)	Experimental Rating (f)
*Flute	Firmly Female	Unclear
Clarinet	Slightly Female	Slightly Female
Saxophone – Experimental High	Unclear	Slightly Female
Saxophone – Experimental Low	Unclear	Slightly Male
Trumpet – Experimental High	Slightly Male	Unclear
*Trumpet – Experimental Low	Slightly Male	Firmly Male
Trombone	Slightly Male	Unclear
Tuba	Firmly Male	Firmly Male

Note. Mode perceptions of each instrument’s gender are shown.

*Indicates statistically significant difference in ratings of control and experimental conditions

Non-Music Majors

The flute's ratings were compared after participants listened to it perform at the midpoint of its range and in the lower extreme of its range. On average, the flute was rated less feminine when it played at the lower extreme of its range ($Mdn = 3$) than when it played at the midpoint of its range ($Mdn = 5$). A Wilcoxon signed-rank test indicated that this difference was statistically significant, $T = 263, z = 3.33, p = 0.0009$.

The clarinet's ratings were compared after participants listened to it perform at the midpoint of its range and in the lower extreme of its range. On average, the clarinet was rated less feminine when it played at the lower extreme of its range ($Mdn = 3$) than when it played at the midpoint of its range ($Mdn = 4$). A Wilcoxon signed-rank test indicated that this difference was statistically significant, $T = 183, z = 2.78, p = 0.0054$.

For the saxophone, a Friedman's test showed that there was a significant difference between the saxophone's ratings at the midpoint, low, and high ranges, $\chi^2_r(2) = 14.06, p = 0.0009$. Post hoc tests using a Wilcoxon signed-rank test showed that the saxophone was rated as more feminine when it played at the higher extreme of its range ($Mdn = 4$) than when it played at the midpoint of its range ($Mdn = 2$). This change in its perceived gender was statistically significant, $T = -218, z = -2.48, p = 0.013$.

For the trumpet, a Friedman's test showed that there was a significant difference between the trumpet's ratings at the midpoint, low, and high ranges, $\chi^2_r(2) = 22.92, p < 0.0001$. Post hoc tests using a Wilcoxon signed-rank test showed that the trumpet was rated as more feminine when it played at the higher extreme of its range ($Mdn = 3$) than when it played at the midpoint of its range ($Mdn = 2$). This change in its perceived gender was statistically significant, $T = -242, z = -3.25, p = 0.0012$. Post hoc tests using a Wilcoxon signed-rank test also showed that

the trumpet was rated as more masculine when it played in the lower extreme of its range ($Mdn = 1.5$) than when it played at the midpoint of its range ($Mdn = 2$). This change in its perceived gender was statistically significant, $T = 83, z = 2.59, p = 0.0096$.

The trombone's ratings were compared after participants listened to it perform at the midpoint of its range and in the higher extreme of its range. On average, the trombone was rated less masculine when it played at the higher extreme of its range ($Mdn = 2$) than when it played at the midpoint of its range ($Mdn = 2$). A Wilcoxon signed-rank test indicated that this difference was statistically significant, $T = -138, z = -2.57, p = 0.010$.

There were no significant differences found for non-music majors' perceptions of the tuba performing in a range that countered the instruments' established instrument-sex-stereotype. See Table 3 for a summary of non-music majors' mode (f) perceptions of each instrument's gender ratings.

Table 3

Non-Music Major's Mode (f) Perceptions of Each Instrument's Gender

Instrument	Control Rating (f)	Experimental Rating (f)
*Flute	Firmly Female	Unclear
*Clarinet	Slightly Female	Slightly Male
*Saxophone – Experimental High	Slightly Male	Slightly Female
Saxophone – Experimental Low	Slightly Male	Firmly Male
*Trumpet – Experimental High	Slightly Male	Unclear
*Trumpet – Experimental Low	Slightly Male	Firmly Male
*Trombone	Firmly Male	Slightly
Tuba	Firmly Male	Firmly Male

Note. Mode perceptions of each instrument's gender are shown.

*Indicates statistically significant difference in ratings of control and experimental conditions.

Comparisons of Ratings Between Music and Non-Music Majors

Gender ratings for the trumpet in the higher extreme of its range assigned by music majors ($M = 2.63$) were more masculine than those of non-music majors ($M = 3.41$). A Mann-Whitney test indicated that this difference was statistically significant, $U(N_{\text{music majors}} = 32, N_{\text{non-music majors}} = 32) = 686, z = -2.33, p = 0.02$. Gender ratings of the trombone at the midpoint of its range assigned by non-music majors ($M = 1.84$) were more masculine than those of music majors ($M = 2.44$). A Mann-Whitney test indicated that this difference was statistically significant, $U(N_{\text{music majors}} = 32, N_{\text{non-music majors}} = 32) = 343.5, z = 2.26, p = 0.024$. No other ratings of instrument gender between music majors and non-music majors were significantly different.

The Mann-Whitney test was also used to compare participants independent ratings as a function of participant sex. No ratings of instrument gender between female and male participants were significantly different.

Discussion

The purpose of this study was to examine the effect of pitch height on instrument gender ratings. For all instruments included in the study (flute, clarinet, saxophone, trumpet, trombone, and tuba), the juxtaposition of established instrument-sex-stereotypes with an opposing performance range (i.e., male instruments playing high notes and female instruments playing low notes) produced a change in mean gender rating. For all instruments except the tuba, the alteration of performance range also produced a change in which gender rating was most frequently assigned to the instrument.

Similar to Stronsick et al.'s (2017) findings, this study found that, at the midpoint of their ranges, the flute and clarinet were most frequently rated as feminine instruments while the trombone and tuba were most frequently rated as masculine sounds. Some discrepancy with

ratings did emerge for the androgynous instruments (saxophone and trumpet) as they played at the midpoint of their ranges. Specifically, both music majors and non-music majors most frequently rated the trumpet at the midpoint of its range as masculine sounds. For the saxophone, non-music majors most frequently rated it as a slightly masculine sound while music majors most frequently rated it as an unclear sound. It is unclear what caused these shifts. More research should be conducted to determine if these shifts of ratings appear outside of students who attend the University of Mississippi.

Non-Music Majors

Non-music majors, as a whole, rated every instrument except the tuba and the saxophone performing in the lower extreme of its range instrument significantly different after adjusting the pitch height. For the flute, 75% of the participants who rated it performing at the midpoint of its range as firmly female changed their rating after hearing it perform in the lower extreme of its range. Similarly, 50% of the participants who rated the clarinet performing at the midpoint of its range as either slightly feminine or firmly feminine changed their rating after hearing it perform at the lower extreme of its range. After hearing the saxophone perform in the higher extreme of its range, the number of non-music major participants who rated it performing at the midpoint of its range as slightly female or firmly female increased from 5 to 17. Compared to its control listening example, hearing the trumpet perform at the higher extreme of its range caused its total number of slightly feminine or firmly feminine ratings to increase from 3 to 15. After hearing the trumpet perform at the lower extreme of its range, the number of non-music major participants who assigned it a rating of firmly masculine increased from 5 to 16. Finally, hearing the trombone perform in the higher extreme of its range decreased its total number of firmly

masculine ratings from 15 to 5. All of this data suggest that pitch height had a significant effect on non-music majors' perceptions of instrument gender ratings.

For the non-musician, the results of this study suggests that pitch height plays a major role in the assignment of genders to instruments. The malleability of the non-musician's perception of instruments' genders further suggests that the instrument-sex-stereotyping behaviors is learned and becomes more ingrained with exposure to music.

Music Majors

Compared to non-musicians, it is very clear that pitch height has a dramatically lower impact on music majors' perceptions of instrument gender ratings. For music majors, pitch height was found to have a significant impact on the flute and the trumpet performing in the lower extremes of their ranges. For the flute, lowering the performance range decreased the number of participants who rated it as firmly female from 16 to 8. For the trumpet, lowering the performance range increased the number of participants rating the sound as slightly masculine or firmly masculine by one-third.

At first glance, it seems random that these two instruments performing in the lower extremes would produce significant results in this investigation. After some thought, it became clear that, unless they are a trumpet player or a flutist, a typical music major does not hear these instruments play such low notes. The typical music major's unfamiliarity of hearing these two instruments perform in the lower extreme of their ranges paired with the significant changes in music majors' perception of these instruments gender ratings suggests that music majors are more likely to have a shift in their perception of an instrument's gender rating when they are unaccustomed to hearing the instrument perform in the new range.

Overall, these findings suggest that a prolonged exposure to music could reinforce instrument-sex-stereotypes to the point that they become more resistant to treatment. Because there seems to be no treatment for the trained ear, musicians must be mindful of passing on possible instrument-sex-stereotyping behavior to young students. Those who teach beginning level students should exhibit extreme caution during the instrument selection process and remember to encourage students to select the instrument that will bring them the most success and that will foster the most love for music.

Comparisons of Ratings Between Music and Non-Music Majors

Comparative analysis revealed that music majors and non-music majors rated the trumpet in the higher extremes of its range significantly different. Music majors rated the trumpet in that range as overwhelmingly more masculine while non-music majors did not. This difference in rating can be attributed to the fact that non-music majors relied more on the pitch height than music majors. Further, this difference can be attributed to the imagery that comes to mind when music majors think of hearing the trumpet play high (i.e., a male performing over-exerting himself to play high notes during his jazz concert). Further studies could be carried out to examine how musicians use their auditory senses to visualize performances.

An interesting finding of this study is that, regardless of participant major, there were no significant differences in how male and female participants rated their perception of the instruments' genders. Unlike other studies, this finding suggests that the perception of instrument genders has more to do with cognitive functions and less to do with the listener's sex. More research could help to determine to what degree these cognitive functions affect the rating process. Further, the inclusion of allowing participants to self-describe their sex could provide a more holistic view of how participant sex affects their perceptions of instrument gender ratings.

Conclusion

It should be noted that, as humans, it is extremely hard to completely separate pitch height from timbre. This is especially true when listeners are already familiar with each instrument's special sound. When paired with this study's findings, it becomes clear that music majors' perceptions of instruments' gender ratings might be less likely to change because musicians are able to subconsciously recognize instruments based on their timbre. This study's findings further suggest that non-music majors' perceptions of instruments' gender ratings might be more likely to change because, in the absence of being able to recognize which timbre belongs to which instrument, the untrained ear relies more on pitch height to assign gender ratings.

This study is important because it proves that the sounds produced by instruments are just as important to the listeners' perception of an instrument's gender as the physical size and shape of the instrument. Overall, these findings offer new clarity regarding why instruments have perceived genders and how these perceptions can be altered.

Future Research

Due to the limited population tested in this study, the next steps needed in this field of research involve the use of a larger, more diverse sample. Once it is established that the trends discussed in this work exist in participants who do not attend the University of Mississippi, a more thorough investigation should examine the effect of repeated exposure to instruments performing at ranges that counter their established instrument-sex-stereotype. A final study should include in-person concerts for non-musicians to determine whether the sound of the instrument or the demonstrator's sex has a greater influence on the instrument's perceived gender rating.

The findings of this investigation can also lead to studies involving school-aged musicians, including an investigation that focuses on students who are preparing to enter beginning level band programs. A study of students' perception of instrument genders at this young age could have tremendous implications for the beginning band director's recruitment process. Any findings in this setting could help directors plan more purposeful instrument demonstrations while also allowing them the opportunity to combat any of the instrument-sex-stereotype behaviors that students might exhibit at this age. Ultimately, this newfound tool could help free students from the instrument-sex-stereotyping behavior, which, in turn, gives students less inhibitions during the instrument selection process. When students no longer exhibit the stereotyping behavior and are able to freely choose their instrument, they will be able to reach new levels of success.

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APPENDICES

APPENDIX A

Survey Instrument

Start of Block: Demographic Questions

1. **Study title:** The Effect of Pitch Height on Instrument Gender Ratings

Researcher: Raven Thompson (Master of Music Student)

What is the purpose of this study?

The purpose of this study is to better understand how sound affects the perceived gender-appropriateness of instruments.

What will I do?

This survey will ask you to listen to 14 brief listening examples, then select the answer choice that best reflects your perception of the instrument's gender.

How long will it take?

5-8 minutes

Questions about the research, complaints, or problems:

Contact Raven Thompson (rdgordo1@go.olemiss.edu)

Agreement to Participate

Your participation is completely voluntary, and you can withdraw at any time. If you would like to take the survey, select "Yes, I consent."

- Yes, I consent
- No, I do not consent

*Skip To: End of Survey If Study title: The Effect of Pitch Height on Instrument Gender Ratings
Researcher: Raven Thompson (M... = No, I do not consent*

2. How old are you?

- 15-17
- 18-25
- 26 or older

Skip To: End of Survey If How old are you? != 18-25

3. Which of the following best describes your major?

- I am a music major.
- I am not a music major.

Skip To: 6 If Which of the following best describes your major? = I am a music major.

Page Break

4. Have you participated in band, choir, orchestra, or music lessons for more than 2 years?

- Yes
- No

Skip To: End of Survey If Have you participated in band, choir, orchestra, or music lessons for more than 2 years? = Yes

5. What is your sex?

- Male
- Female

End of Block: Demographic Questions

Start of Block: Control Listening Examples

6. Listen to the example, then select the rating the reflects your perception of the instrument's gender.

- Firmly Male
- Slightly Male
- Unclear
- Slightly Female
- Firmly Female

7. Listen to the example, then select the rating the reflects your perception of the instrument's gender.

- Firmly Male
- Slightly Male
- Unclear
- Slightly Female
- Firmly Female

8. Listen to the example, then select the rating that reflects your perception of the instrument's gender.

- Firmly Male
- Slightly Male
- Unclear
- Slightly Female
- Firmly Female

9. Listen to the example, then select the rating that reflects your perception of the instrument's gender.

- Firmly Male
- Slightly Male
- Unclear
- Slightly Female
- Firmly Female

10. Listen to the example, then select the rating that reflects your perception of the instrument's gender.

- Firmly Male
- Slightly Male
- Unclear
- Slightly Female
- Firmly Female

11. Listen to the example, then select the rating that reflects your perception of the instrument's gender.

- Firmly Male
- Slightly Male
- Unclear
- Slightly Female
- Firmly Female

End of Block: Control Listening Examples

Start of Block: Experimental Listening Examples

12. Listen to the example, then select the rating that reflects your perception of the instrument's gender.

- Firmly Male
- Slightly Male
- Unclear
- Slightly Female
- Firmly Female

13. Listen to the example, then select the rating that reflects your perception of the instrument's gender.

- Firmly Male
- Slightly Male
- Unclear
- Slightly Female
- Firmly Female

14. Listen to the example, then select the rating that reflects your perception of the instrument's gender.

- Firmly Male
- Slightly Male
- Unclear
- Slightly Female
- Firmly Female

15. Listen to the example, then select the rating that reflects your perception of the instrument's gender.

- Firmly Male
- Slightly Male
- Unclear
- Slightly Female
- Firmly Female

16. Listen to the example, then select the rating that reflects your perception of the instrument's gender.

- Firmly Male
- Slightly Male
- Unclear
- Slightly Female
- Firmly Female

17. Listen to the example, then select the rating that reflects your perception of the instrument's gender.

- Firmly Male
- Slightly Male
- Unclear
- Slightly Female
- Firmly Female

18. Listen to the example, then select the rating that reflects your perception of the instrument's gender.

- Firmly Male
- Slightly Male
- Unclear
- Slightly Female
- Firmly Female

19. Listen to the example, then select the rating that reflects your perception of the instrument's gender.

- Firmly Male
- Slightly Male
- Unclear
- Slightly Female
- Firmly Female

End of Block: Experimental Listening Examples

APPENDIX B

Musical Notation of Listening Examples

Figure 1

Flute – Control



Figure 2

Flute – Experimental



Figure 3

Clarinet – Control



Figure 4

Clarinet – Experimental



Figure 5

Saxophone – Control



Figure 6

Saxophone – Experimental High

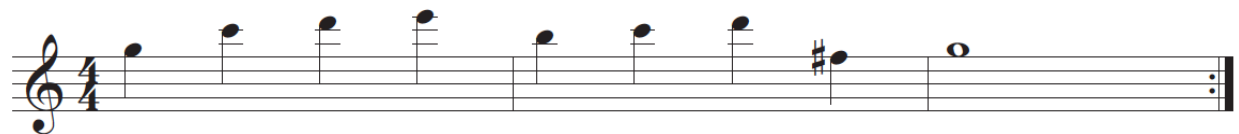


Figure 7

Saxophone – Experimental Low



Figure 8

Trumpet – Control



Figure 9

Trumpet – Experimental High

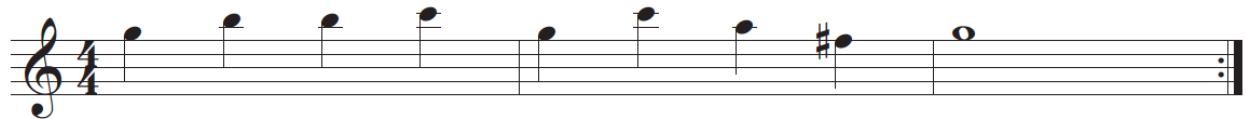


Figure 10

Trumpet – Experimental Low



Figure 11

Trombone – Control



Figure 12

Trombone – Experimental

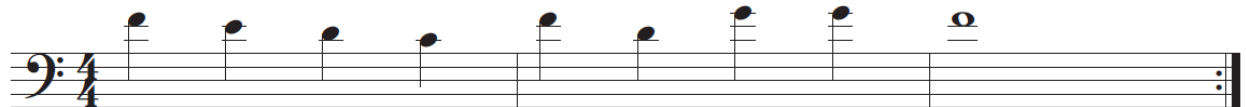
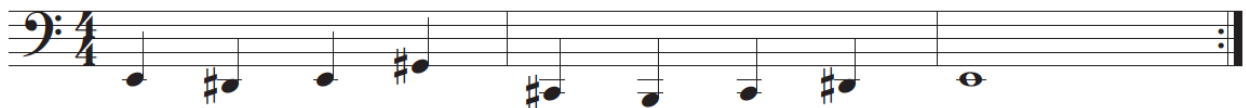


Figure 13

Tuba – Control



VITA

Raven Gordon Thompson graduated from Senatobia High School in 2013, after which she attended the University of Mississippi. Upon graduating with her Bachelor of Music in 2017, Raven taught middle school band in the Tupelo Public School District until 2020, when she returned to the University of Mississippi to obtain her Master of Music. During her time in the graduate program, Raven received numerous academic awards, such as the 2021 Outstanding Graduate Student in Music Education and the prestigious 2022 Graduate Achievement Award in Music. Raven currently resides in Oxford, Mississippi with her beloved husband and plans to return to the classroom in August of 2022.