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PATTERNS OF ATTRACTIVENESS AND DOMINANCE AS RELATED TO VOICE
FREQUENCY ACROSS CULTURES

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ABSTRACT

The purpose of this study is to determine to what extent women's perceptions of a man's short and long-term attractiveness, as well as men's perceptions of other men's prestige and dominance, are affected by the fundamental frequency of his voice. There is already evidence that indicates a positive association between perceptions of masculinity, attractiveness and dominance, and a lower F_0 , but little research has been conducted to estimate the degree of cross-cultural variability in these perceptions. The following analyses strives to elucidate the similarities and differences in perceptions across five nations, as well as to interpret these results from cultural and evolutionary perspectives.

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Chapter 1

Introduction

Sexual dimorphism is the set of secondary sexual characteristics which differentiate male and female phenotypes (Park, 2017). These differences often evolve to aid in competition for mates, for example through attracting members of the opposite sex, or by helping in contests with competitors. As a result, males of many species have evolved various ornaments and weapons to increase their own chances of reproduction (e.g. the feathers of a male oriole, or the antlers of most species of deer) (Darwin, 1871; Perez-Babaria et al. 2002). Humans are also subject to these mechanisms, being rated the 8th most visually dimorphic species of primate, and within 90th percentile for visual dimorphism overall. (Dixson et al. 2005).

Besides visually dimorphic traits, acoustic parameters have also been identified as highly sexually dimorphic in humans (Banse & Scherer, 1996). Fundamental frequency (F_0), commonly perceived as pitch, is one of the most prominent differentiators between men's and women's voices, with men's voices being approximately half as high as those of women. (Titze et al. 2000; Puts et al. 2006). The proximate causes of men's deeper voices are not primarily attributed to differences in height or body volume; rather, including factors influenced and maintained by testosterone (Puts, 2005). Since various studies have demonstrated female preference for a low male voice pitch, it follows that more masculine fundamental frequencies have evolved as a way to attract mates. (Dabbs & Mallinger, 1999; Puts et al., 2006). Additionally, women have been found to prefer men with more masculine voices near ovulation,

or when rating men's attractiveness for a short-term relationship, which may indicate increased desirability for masculine traits (such as lower F_0) when the odds of conception are higher (Collins, 2000; Feinberg et al., 2005; Puts et al. 2007). However, it is unknown the degree to which these preferences are consistent across cultures.

It is possible that women may consider vocal masculinity attractive because it is an indicator of a man's dominance and social status (hereafter known as *prestige*). Dominance, as discussed in this paper, refers to the ability to influence others, through social or physical mechanisms associated with aggression, and agonism. Perceived dominance has been shown to allow men a variety of advantages, especially for those seeking short term relationships, where acts of dominance raised perceived reproductive value (Schmitt & Buss, 1996). Prestige, on the other hand, is the amount of social influence *willingly* conferred to an individual, and generally considered a more pro-social trait than dominance (Drews, 1993; Henrich et al. 2001). Since women prefer traits such as ambition, diligence and financial stability in a partner, and such traits are generally considered prestigious, prestige would then be a good indicator of attractiveness (Li et al. 2002). Interestingly, dominance has been positively related to testosterone levels, as well as self-reported indicators of aggression, while prestige is more negatively correlated to testosterone (Burk et al. 2007; Puts et al. 2006). Given this negative correlation, men seeking mates may benefit from masculine F_0 up until a point at which their voice has fallen too far below the average, where it may negatively impact perceived prestige and be construed with aggressive behavior. Additionally, conscious and unconscious voice modulation may have an impact on such perceptions. Women have evolved preferences for mates who invest in their offspring, and studies have shown men with higher testosterone invest less in relationships, leading to less satisfaction in both partners (Geary, 2000; Edelman et al. 2014). Depending on cross-cultural

attitudes regarding a man's role in child rearing, the attractiveness of low F_0 could vary from country to country.

Concurrently, men perceive male voices with more masculine F_0 to be older, larger, physically and socially dominant, as well as more attractive to women (Collins, 2000; Puts et al. 2005; Wolff and Puts, 2010; Puts et al. 2007). However, in American men, F_0 was more predictive of short-term mating success and dominance than it was indicative of an overall attractiveness to women (Puts et al., 2006). If true, this implies that masculine F_0 could be a stronger indicator of dominance amongst men, than an attractiveness to women. What has yet to be studied, however, is whether this holds true in a cross-culturally. By compiling responses from participants across cultures, it can be ascertained to what extent cultural or linguistic perceptions of attractiveness, dominance and prestige differ.

Knowing this, there are several results one may hypothesize. Firstly, it is expected that vocal masculinity will increase men's attractiveness amongst women until the costs of mating with a masculine male (e.g. decreased investment and increased physical threat) exceed possible benefits, such as possible genetic benefits or protection. In this case, masculine F_0 should either have a linear effect on women's perceptions of attraction, or a curvilinear effect. If linear, it could be said that women have increasing interest as men's voices become more masculine, indicating that the trade-offs of masculinity are not as important a consideration as masculinity itself. If curvilinear, women would demonstrate a preference for masculinity, with greater emphasis on voices closer to the male average, as these men may exhibit fewer negative masculine traits. It is predicted that masculinity will increase women's perceptions of male vocal attractiveness overall, but this attraction will be more pronounced when women consider these

men for a short term relationship, given that his relationship has already been identified in several previous studies (Schmitt & Buss, 1999; Puts et al. 2016). Concerning prestige and dominance amongst men, it is hypothesized that a lower fundamental frequency will increase perceptions of men's status by other men, especially since it was found that artificially lowering F_0 increased men's perceptions of dominance, with greater emphasis on physical dominance than on social dominance (Puts et al. 2006). Thus, it is predicted that F_0 will have a greater influence on men's perceptions of dominance and prestige than on attractiveness, especially considering previous research indicating such a trend (Puts et al. 2006). Studying this effect will also allow for a comparison between both sexes attitudes towards masculine F_0 , and which sex seems most affected by it.

Chapter 2

Methodology

Participants

In this IRB approved study, participants were recruited in two ways. University samples were collected from students and non-students alike, provided all participants were native speakers of the target language being collected. Participants were also gathered outside of a university setting, and were allowed to participate as long as the aforementioned requirements were met. In China, there were 27 participants (13 men and 14 women) collected both inside and outside a university setting. The average age of Chinese participants was approximately 23, with a standard deviation of ~3.8 years. In this sample, 20 participants were single, 3 were dating and 3 were married, with one person not providing relationship information. Additionally, 13 of the women sampled indicated they were only attracted to men, and 6 of the men sampled indicated a strict preference for females. In Peru there were 32 participants (16 males and 16 females) with an average age of ~32 and standard deviation of ~10.6 years who were recruited outside a university setting. 18 of these participants were single, 7 dating, and 7 cohabitating or married. No data referring to their preferred sexual orientation was collected. In Iran, there were 35 participants (22 males and 13 females) recruited outside of a university setting, with a mean age of ~27.2 and standard deviation of ~4 years. 11 participants in this sample were single, 12 dating and 12 married. 22 Peruvian men indicated a strict preference for females, 8 women a strict preference for men, and 5 women a preference for mostly men. There were 35 Ugandan men and

women included in this study (18 men and 17 women) and recruited outside of a university setting. The average participant age was ~ 25.2 , with a standard deviation of ~ 5 years. 21 of the Peruvian participants were single, 7 dating and 6 cohabitating or married, with one not providing relationship information. Of these men, 8 were only attracted to females, 2 were mostly attracted to females, 4 were equally attracted to both males and females, 1 was mostly attracted to men, and 1 was attracted only to men. Of these women, 8 were attracted only to men, 2 were attracted mostly to men, 2 were equally attracted to males and females, 2 were mostly attracted to females, and two were attracted only to females. 3 participants did not provide data regarding their sexual orientation. 200 men and women (77 men and 123 women) were recruited within a university setting in the United States, with an average age of ~ 20.5 , and standard deviation of ~ 4.5 years. Within this sample, 110 participants were single, 83 were dating and 7 were cohabitating or married. Of American men, 61 were only attracted to women, 2 were attracted mostly to women, and equally to males and females respectively, 1 was mostly attracted to men and 4 were only attracted to men. Of females, 91 were attracted only to men, 25 were attracted mostly to men, 4 were attracted equally to males and females, 2 were attracted mostly to females, and 1 was strictly attracted to females.

Stimuli

Two hundred and fifty-eight female (mean age + s.d. = $20.0+1.6$ years) and 175 male ($20.1+1.7$ years) students from Michigan State University provided written consent to participate in this study approved by the university's institutional review board. Participants were recorded

reading a standard voice passage [53] in an anechoic, soundproof booth using a Shure SM58 vocal cardioid dynamic microphone (frequency response: 50–15 000 Hz) positioned at approximately 30 degrees and 9.5 cm from the speaker's mouth, and connected to a desktop computer via a Sound Devices USBPre 2 preamplifier. Voices were recorded in mono at a sampling rate of 44 100 Hz and 16-bit quantization, and saved as uncompressed .wav files (Puts et al, 2016). In order to acquire stimuli suitable for this experiment 25 voice samples of both men and women were selected from their respective samples, and of these, two were selected for each sex based on the following criteria.

Firstly, the mean F_0 and P_f of each of these participants' voices were each within one standard deviation of the mean F_0 of their sex-specific voice samples. P_f is the average standardized formant value for each of n values, and has been linked more strongly to testosterone than F_0 (Puts et al. 2012). Additionally, neither of the selected female participants were taking oral contraceptives at the time of recording). Once selected, the average F_0 and range of each of these voices was measured using *Praat* voice analysis software. Including manipulations, Women's voices ranged from approximately 93 to 471.2 Hz and had a mean of 210.8 Hz, whereas men's voices ranged from approximately 72.5 to 229.3 Hz with a mean of 123 Hz. The frequency of each voice was manipulated to be two standard deviations higher and lower. Depending on the voiced and unvoiced components of each voice, inaccurate manipulations by the utilized software was a possibility. As a result, some voice samples were excluded. The remaining samples were deemed to sound the most natural (or had the fewest detectable instances of failed manipulation), and so were selected as stimuli for this experiment.

After suitable voice samples were collected, five separate F_0 manipulations were conducted upon them. Using *Praat* software, each of the voices was manipulated until it matched

the: a) mean sample pitch (Females: 5.881 ERB, Males: 3.687 ERB), b) one standard deviation above and below the mean (Females: 0.339 ERB, Males: 0.280 ERB), and c) two standard deviations above and below the mean (Females: 0.678 ERB, Males: 0.559 ERB). Unmanipulated voices were used as the basis for each new stimulus in order to ensure that each of the stimuli was the result of just one manipulation, and reduce possible unintended distortion. Using the media software *Audacity*, each voice clip was shortened to only include the independent clause “They act as a prism and form a rainbow”, to help reduce fatigue amongst participants.

Each of the stimulus pairs were two standard deviations apart, which led to the creation of three separate pairs: a 2SD feminized pitch with the mean pitch, a 2SD masculinized pitch with the mean pitch, and a 1SD feminized pitch with a 1SD masculinized pitch. The last pair was included to detect the degree to which manipulation could be affecting preference, instead of changes in pitch (e.g. preference for the average pitch could be higher because it is the least manipulated of the stimuli).

Procedure

Administration

The study was administered using an iPod and Sennheiser HD280 Professional 64 ohm headphones. An experimenter controlled by the iPod, randomizing stimulus presentation order, which was done through the shuffle function of the iPod. Participants were asked to select which of the two voices best satisfied the proposed question. The experimenter marked the participant’s response in the appropriate box on a response sheet. All respondent sheets were withheld from the participants, so as not to affect their perceptions of the voices. Prior to the

collection of voice preference data, participants were asked to complete a questionnaire that included: age, relationship status, number of living children, and sexual orientation/attraction. Sexual orientation and attraction was measured on a 5-point scale ranging from “only females” to “only males”. Female participants were presented with a series of yes/no questions regarding pregnancy, lactation, and contraceptive use, as well as average length of menstrual cycle, days since last menstrual bleeding, and days until the start of the next period. Each question was voluntary. After completion of the questionnaire, participants listened to, and evaluated, two aspects of both male and female voices using forced-choice methodology

Voice Evaluation – Male Participants

Male participants were presented with unique pairs of male voices and asked to judge which of the two voices sounded more “respected, admired, talented and successful”, and which sounded “more likely to win a physical fight”. Participants were also asked to judge pairs of female voices on which sounded “more attractive for a short-term, uncommitted romantic relationship”, and which was “more attractive for a long-term committed relationship such as steady dating or marriage”.

Voice Evaluation – Female Participants

Female participants were asked to judge female voices on which voice in each pair would be more “attractive to men”, and which sounded more “interested in attracting men”. In addition, female participants were asked to judge male voices as to which of each pair

sounded - “more attractive for a short-term, uncommitted romantic relationship”, and which of each pair was “more attractive for a long-term committed relationship such as steady dating or marriage”.

Counterbalancing and Randomization

To eliminate the influence of order effects, two iTunes playlists were created for each sex. Each playlist features 6 pairs of voices, with 3 pairs from each of the stimuli. Two pairs feature the mean pitch first, two pairs feature the masculinized pitch first, and two pairs feature the feminized pitch first. If one playlist begins with a voice that was feminized by one standard deviation, the complementary playlist began with a voice that was masculinized by one standard deviation. Further, the shuffle function on the iPod was used to randomize the order of each voice pair in any one album. Approximately half of all participants listened to the first album in the relevant album set, and the other half the second. At the same time, it was ensured that participants never listened to more than one voice set of any sex in a row. Participants would listen to a female set, then a male set, and vice versa. They would never listen to two female or two male sets at a time. This was done in order to reduce participant fatigue. Additionally, question order was randomized, which when combined with randomization of vocal stimuli resulted in the creation of 16 individual respondent sheets.

Chapter 3 Results

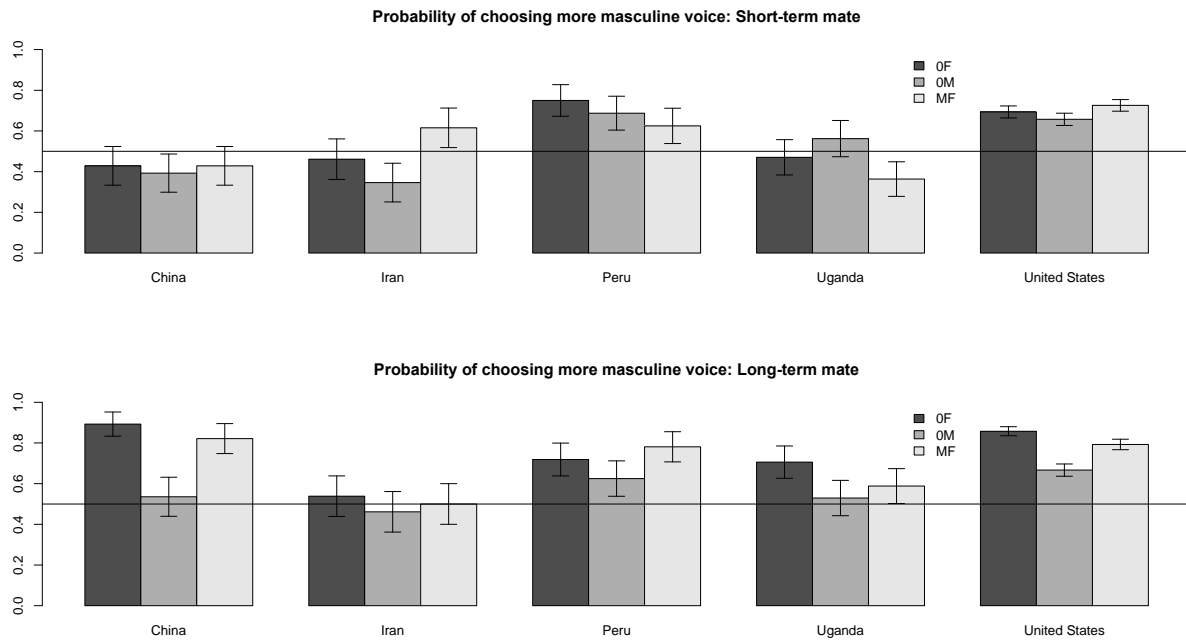


Figure 1. Probability of choosing a more masculine voice, 2017

When considering a potential mate for a short-term relationship, women preferred the more masculine voice in seven out of the possible 15 (5 countries x 3 manipulations) cases, and these preferences for masculinity were confined to Iran, Peru and the United States. This preference is illustrated by an overall difference in preference of about 10 percentage points. In addition, the OM stimulus category was the least popular category amongst women, no matter the stimulus question related to the length of a potential relationship. This unpopularity was demonstrated by another drop of approximately 11 percentage points.

In three cases across China, Iran and Peru, women preferred the more feminine of the stimulus pair. Interestingly, despite women's preference for masculinity across manipulations in Peru and the United States, Iranian women preferred the more masculine stimulus only when

masculinized and feminized voices were paired (MF) and in a short-term mating context. In the United States, women were more likely to choose masculine voices in MF and OF pairings, than in OM pairings. In Peru, OF was more preferred than MF. This indicates that Peruvian women preferred masculinized voices when paired with more feminized voices. In the United States, women preferred masculine voices when average masculine and feminized voices were paired, but less so when comparing more feminized (OF) and masculinized (OM) pairs. China, Iran and Uganda each had one statistically significant preference for the more feminine voice. In Iran, women preferred voices closer to the male average when presented with a more masculine alternative. Alternatively, Ugandan women preferred the more feminine stimuli within one standard deviation above and below the mean (MF).

When considering a mate for a long-term relationship, women preferred more masculine voices than they had for a short-term relationship. In 10 out of 15 categories across all countries with the exception of Iran, women preferred the masculinized voice. In China, women preferred more masculine voices to feminized ones in the OF pairing and MF pairing, though not to a significantly different extent. Women in the US preferred masculinity in an OF more than an MF pairing, and MF more than OM. Chinese and American women exhibited similar preferences for masculinity, though the difference between OF and MF in China was not significant. Ugandan women's preferences also seemed to mirror those of women in China and the United States, with only OF and MF categories showing a statistically significant preference. Neither Iranian, nor Peruvian women had any statistically significant preferences for masculinity in any category.

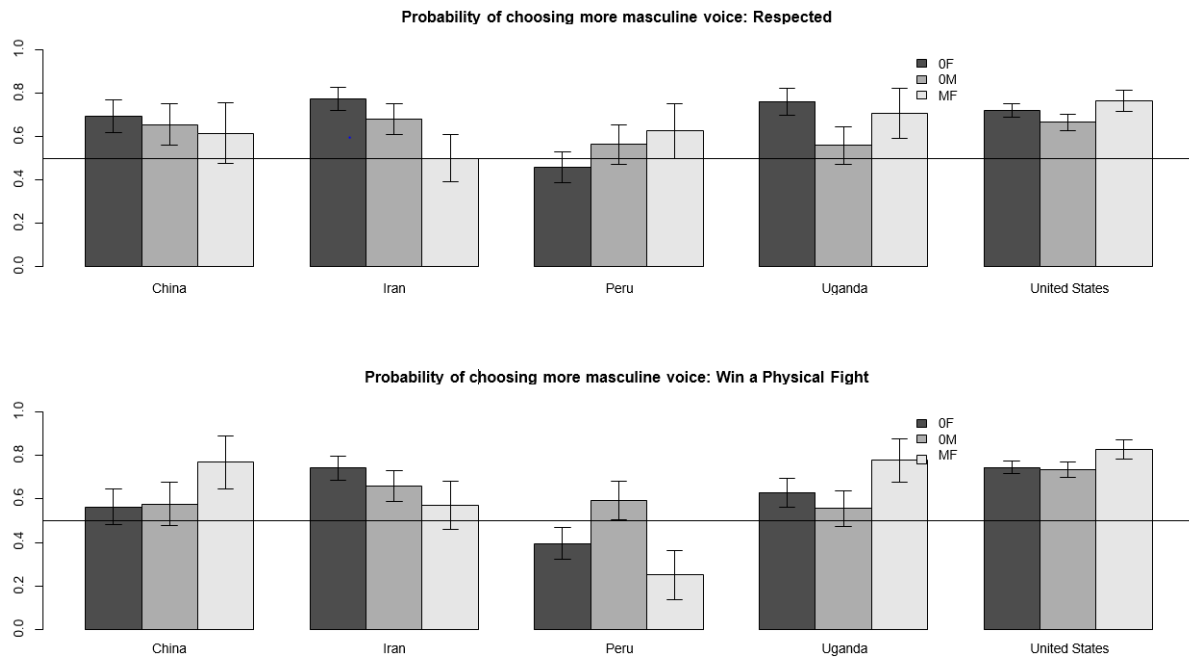


Figure 2. Probability of choosing a more masculine voice, Status

In nine out of 15 cases, men tended to rate more masculinized voices as sounding more prestigious. In China, men were more likely to pick the masculinized voice in OF and OM pairings, but there was no statistically significant difference between either category. Iranian men chose the masculinized voice in OF and OM pairings as well, though preference for masculinity in the OF pairing was greater than in OM. In Peru there were no stimuli categories which demonstrated a preference. When comparing Uganda and the United States, masculine preference was pronounced in both OF and MF stimuli, though American men also chose masculinized voices in the OM category at about the same rate as OF voices.

When men were presented with the same stimuli and asked which voice sounded more likely to win a physical fight, there were 9 categories of 15 in which men had a higher probability of choosing the masculinized voice. In the US, men preferred the MF category (1SD of manipulation in both directions) more than both OF and OM samples, which were chosen at

nearly identical rates. Similarly, Chinese and Ugandan men also preferred MF to the OF and OM stimuli. Alternatively, Iranian men preferred masculinity in the OF and OM categories, but not to a significant degree. Peruvian men, surprisingly, seemed to prefer femininity to a significant degree when considering MF and OF stimuli, with there being a very pronounced preference in MF choices. However, these same men were more likely to choose masculinity when presented with a highly masculinized voice vs. average F_0 (OM pairs).

Chapter 4

Discussion

The first step in analyzing the results of the experiment is to determine to what extent each of the five sample countries display consistent results. In doing so, one will be able to better identify the extent to which vocal preferences may vary based on local conditions. Across samples, two broad trends were observed. Firstly, there was an overall pro-masculinity trend in men, and what could be called an anti-femininity preference in women. While noticeable, this trend is not all encompassing, and in fact does little to characterize country by country results. Secondly, men and women in each country seem to have their own conceptions of the attractiveness and status bestowed by masculinity.

Women's Preference for Masculinity: Short-term vs. Long Term

Based on the results of this study, women appear to prefer masculinity for long-term relationships, more so than for short-term relationships. Previous studies have supported the idea that women prefer deeper voices, as long as they do not fall below an established masculine threshold. One study showed that masculine voice below a frequency of 96Hz, actually influenced women to select a more feminine voice as sounding the most attractive (Feinberg et al. 2012). It has been hypothesized that a curvilinear preference for masculinity (preferring more average sounding masculine voices) could have developed in order to stabilize selection pressure for lower pitched voices, preventing the development of lower pitched voices from becoming too costly in terms of resources expended in order to develop a suitable larynx (Andersson, 1994). Additionally, men with a speaking pitch lower than ~70Hz may lose the ability to accurately transmit emotional signals, and participate in singing or speaking rituals, which may negatively affect their attractiveness to women (Feinberg et al. 2012). This same tendency may explain why men's ability to effectively tell a story predicted their long-term attractiveness to women, but not their short-term attractiveness, or women's attractiveness to men (Donahue & Green, 2016). In this case, a tendency to avoid masculine voices, which fall too far outside of the male average would produce a curvilinear relationship between fundamental frequency and perceived attractiveness of men by women.

Women's preference for more masculine voices in the long term may also reflect an avoidance of men whom they do not know well, and may potentially pose a greater threat. In a recent study, the only significant indicator of women's preference for masculinity in the faces of men was their propensity to avoid violence (Borras-Guevera et al. 2017). Women who agreed with the idea that, "men are dangerous to their children," were less likely to prefer masculinity in

European and Salvadoran male faces (Borras-Guevera et al. 2017). Since more masculine voices are good indicators of dominance, and dominance can imply a propensity for violence towards women, it may make sense for women to prefer greater masculinity in the long-term as opposed to the short-term (Fogany, 1999). Women may feel they know mates selected for a long-term relationships better than those selected for short-term relationships, and so may feel more assured that the risks associated with dominance and masculinity are lessened. In the past, it has been found that when the potential for male-on-female violence was raised, women's preference for masculinity fell (Li et al, 2014). This finding may also indicate that avoiding more masculine sounding men in the short-term provides women with an opportunity to minimize the risk of a violent partner, and maximize reproductive potential.

Men's Preference for Dominance vs. Women's Preference for Long-term Mate

Since this study showed a distinct preference for more masculine voices in long-term relationships, as compared with short-term relationships, comparing women's preferences for masculinity in a long-term relationship with a man's preference for masculinity in physical contests can help determine which preference seems to be exert the greatest influence in sexual selection. As can be seen in the figures, there is a statistically significant pro-masculine trend for the responses of both men and women. Both samples preferred masculine voices within the MF bracket to a greater degree than in OM and OF brackets. At the same time, women seemed to have a greater average preference for masculinity in long-term mates, than men had when considering dominance.

This indicates that deeper fundamental frequencies both have a measurable impact on women's perceptions of attractiveness, and to a lesser extent on men's perceptions of dominance. Such a conclusion would imply that masculine voices both convey a powerful competitive message to other men, as well signal attractiveness to women. This dominant message is supported by a tendency for men who rate themselves as dominant to lower their voices when competing. Additionally, low D_f and F_0 rely on high androgen levels to develop, and since higher androgen levels often indicate healthiness, such signals may indicate a more competitive, physically imposing, and potentially attractive, man (Puts et al. 2007). Despite this, it has also been noted on several occasions that while masculine traits are an indicator of physical fitness, they are also an indicator of antisocial behaviors, which could lead women to avoid voices that seem unusually masculine (Vukovic et al. 2011). If this is the case, it is further support for women's avoidance of masculine voices falling too far below the mean.

Overall Conclusions

The results of these comparisons seem to indicate two things. Firstly, within the sample of women, there is a distinct preference for masculine voices, though less so when voices fall too far below the mean voice frequency. It could then be said that women tend to prefer masculine voices to feminine, with a falling proportion of desirability as said voices decrease in frequency by too many standard deviations, indicating a curvilinear preference for masculinity. Women also prefer masculine voices when considering them for a long-term relationship rather than a short-term relationship. Masculinized voices may sound more dominant, posing a greater

threat of violence in the short-term, which may then be mitigated by the perceived length of a potential relationship. Men also tend to prefer masculine voices, albeit to a greater extent than women. The largest discrepancy between the two sets of data seem to be that men simply have a greater, and flatter, preference for masculinity across the board when evaluating dominance factors. Ultimately, one could say that men seem to demonstrate a masculinity preference, whereas women seem to indicate a tendency to *avoid* femininity, based on their tendency to prefer masculinized voices to feminized voices. While there were certainly measurable trends in regards in both men and women's tendency towards preferring masculinity, some of the more profound results of this study exist within the confines of single country samples. Of these cross-cultural differences, it is Peruvian men's attitudes towards masculine voices and their perceived ability to win a fight that is most surprising.

Peru: Femininity and Physical Contests

It has already been discussed that male voices, when F_0 and D_f are lowered, are perceived as more dominant by other men, and dominance has been continuously linked to aggression and violence (Ainsworth, 2012; Puts et al. 2006) It is hypothesized that this aggression stems from men's historical need to compete over access to mates, which could have provided more evolutionary benefit than mate choice alone. (Archer, 2009). Because of these associations, one would expect for men from each of the sample countries to prefer masculinized voices when considering them as potential victors of a physical fight. For the most part this is true, as each country studied except for Peru exhibited a preference for masculinity, albeit preferences that differed as to the overall depth of the voice. Peruvian men,

surprisingly, seemed to prefer more feminine voices overall. The only preference for masculinity occurred when comparing voices masculinized by two standard deviations from the mean.

The reasons for such a distinct difference could be explained by several phenomenon. Firstly, one cannot overlook the importance of voice modulation. While resonance is often fixed, modulation changes with emotional context, and physical competition could be considered emotionally threatening (Curry, 2015). Since threat detection happens passively within the visual cortex of humans and monkeys, and regardless of the task angry vocal prosody has a distinct effect on the auditory cortex of the human brain, one could draw the conclusion that Peruvian men may be reacting to a culturally conferred cue layered within the vocal samples (Grandjean et al. 2004; Grandjean et al. 2005; Hadjikhani et al. 2003; Sugase et al. 1999). This implies that Peruvian men may have either a cultural propensity to consider higher voices more threatening, or an unconscious tendency to consider the raising of one's voice due to stressful circumstances (and therefore sounding more feminine) as more physically imposing.

The precise mechanism for this preference is unknown, but there lies a possible answer in the Peruvian fighting holiday known as *Takanakuy*. This holiday is celebrated once a year, and encourages members of a Peruvian community, village, or city, to challenge rivals and friends to a physical fight. Challenges are typically made in a high-pitched falsetto, as a means to intimidate one's opponent. (Morton, 2011). It is possible that continues celebration of this holiday has ingrained the idea that voices with arbitrarily higher pitches may signal a challenge to fight, and is therefore considered to be more intimidating. While this holiday originated in the Peruvian countryside, it has spread through much of Peru, and so this may explain why the higher-pitched voices were chosen in the 0F and MF categories as opposed to 0M. Peruvian men would not be exempt from a natural tendency to consider more masculine voices as dominant, just culturally predisposed towards artificially feminine voices.

Chapter 5

Conclusion

Based in the results of this study, there is sufficient evidence to draw a link between F_0 and perceptions of a man's dominance and attractiveness. F_0 seems to influence female perceptions of a man's attractiveness for a long-term relationship most strongly, followed by men's perceptions of other men's social and physical dominance. While these trends existed when observed over all of the nations included in this study, there was enough variation between each country's samples to begin to recognize the role that cross-cultural attitudes may have on perceptions of a man's voice, and to formulate some hypotheses as to why these differences may occur. It seems possible that more masculine F_0 may signal long-term attractiveness as a result of the costs associated with dominant men, namely the potential for violence and abandonment. The extent to which this effect is characterized by women's preferences for deeper male voices may depend on the women's perception of a man's threat potential in their respective countries. What is most consistent is a tendency for women to avoid feminine voices, while preferring voices that most closely align with the male average.

F_0 , as it relates to dominance, seems indicative of both a man's prestige, as well as their physical dominance. The extent to which this preference is characterized across countries is highly variable, especially when comparing a country like Peru (which showed a distinct preference for feminine voices in two of three categories when considering men's physical prowess) to the cross-cultural sample. These findings indicate that more research must be done in both a cross-culture and country-specific contest, in order to better ascertain what mechanisms drive differing preferences for voices with lowered F_0 .

Male Respondent Sheet Sample

Male Respondent A [Albums 1]

Researcher's Initials		Date		Respondent #		Respondent Age	
-----------------------	--	------	--	--------------	--	----------------	--

Relationship Status [Check one]	Single		Dating		Cohabiting/Married	
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Number of living children	
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Step 1: Which voice sounds more respected, admired, talented and successful?		
Male Album 1	1 st Option	2 nd Option
1330AF		
1330MA		
1330FM		
1579FA		
1579AM		
1579MF		

Step 2: Which voice is more attractive for a short-term, uncommitted romantic relationship?		
Female Album 1	1 st Option	2 nd Option
1052AF		
1052MA		
1052FM		
1845FA		
1845AM		
1845MF		

Step 3: Which voice sounds more likely to win a physical fight?		
Male Album 1	1 st Option	2 nd Option
1330AF		
1330MA		
1330FM		
1579FA		
1579AM		
1579MF		

Step 4: Which voice is more attractive for a long-term, committed relationship such as steady dating or marriage?		
Female Album 1	1 st Option	2 nd Option
1052AF		
1052MA		
1052FM		
1845FA		
1845AM		
1845MF		

Sexual Orientation/Attraction				
Only Females	Mostly Females	Equally Males and Females	Mostly Males	Only Males

Appendix B

Female Respondent Sheet Sample

Female Respondent A [Albums 1]

Researcher's Initials		Date		Respondent #		Respondent Age	
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Relationship Status [Check one]	<input type="checkbox"/> Single	<input type="checkbox"/> Dating	<input type="checkbox"/> Cohabiting/Married
---------------------------------	---------------------------------	---------------------------------	---

Number of living children	<input type="text"/>
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Step 1: Which voice would be more attractive to men ?		
Female Album 1	1 st Option	2 nd Option
1052AF		
1052MA		
1052FM		
1845FA		
1845AM		
1845MF		

Step 2: Which voice is more attractive for a short-term, uncommitted romantic relationship ?		
Male Album 1	1 st Option	2 nd Option
1330AF		
1330MA		
1330FM		
1579FA		
1579AM		
1579MF		

Step 3: Which voice sounds more interested in attracting men ?		
Female Album 1	1 st Option	2 nd Option
1052AF		
1052MA		
1052FM		
1845FA		
1845AM		
1845MF		

Step 4: Which voice is more attractive for a long-term, committed relationship such as steady dating or marriage?		
Male Album 1	1 st Option	2 nd Option
1330AF		
1330MA		
1330FM		
1579FA		
1579AM		
1579MF		

Sexual Orientation/Attraction				
Only Females	Mostly Females	Equally Males and Females	Mostly Males	Only Males
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Female Specific Demographic Data				
	Yes	No		Day #
Pregnant?	<input type="checkbox"/>	<input type="checkbox"/>	Length of Average Menstrual Cycle	<input type="text"/>
Lactating?	<input type="checkbox"/>	<input type="checkbox"/>	Days since beginning of last menstrual bleeding	<input type="text"/>
Using contraceptives?	<input type="checkbox"/>	<input type="checkbox"/>	Days until next period	<input type="text"/>

BIBLIOGRAPHY

- Ainsworth, Sarah, and Jon Maner. "Sex begets violence: Mating motives, social dominance, and physical aggression in men." *Journal of Personality and Social Psychology: Interpersonal Relations and Group Processes*, vol. 103, no. 5, 2012.
- Andersson, M. *Sexual selection*. Princeton, NJ, 1994.
- Archer, John. "Does sexual selection explain human sex differences in aggression?" *Behavioral and Brain Sciences*, vol. 32, nos. 3-4, 2009.
- Banse, Rainer, and Klaus Sherer. "Acoustic Profiles in Vocal Emotion Expression." *Journal of Personality and Social Psychology*, vol. 70, no. 3, 1996.
- Borras-Guevara, Martha Lucia, et al. "Aggressor or protector? Experiences and perceptions of violence predict preferences for masculinity." *Evolution and Human Behavior*, 2017.
- Collins, Sarah. "Men's voices and women's choices." *Animal Behavior*, vol. 60, 2000.
- Curry, S. S. *Lessons in Vocal Expression; Course I: Processes of Thinking in the Modulation of the Voice (Classic Reprint)*. Forgotten Books, 2015.
- Dabbs, J., and A. Mallinger. "High testosterone levels predict low voice pitch among men." *Personality and Individual Differences*, vol. 27, 1999.
- Darwin, Charles. *The Descent of Man*. London, 1871.
- Dixson, A., et al. "Sexual selection and the evolution of visually conspicuous sexually dimorphic traits in male monkeys, apes, and human beings." *Annual Review of Sex Research*, vol. 16, 2005.

- Donahue, John, and Melanie Green. "A good story: Men's storytelling ability affects their attractiveness and perceived status." *Personal Relationships*, vol. 23, no. 3, 2016.
- Drews, Carlos. "The Concept and Definition of Dominance in Animal Behaviour." *Behaviour*, vol. 125, 1999.
- Feinberg, D. R., et al. "Manipulations of fundamental and formant frequencies influence the attractiveness of human male voices." *Animal Behaviour*, vol. 69, no. 3, 2005.
- Fogany, P. "Male perpetrators of violence against women: An attachment theory perspective." *Journal of Applied Psychoanalytic Studies*, vol. 1, 1999.
- Grandjean, Didier, et al. "The voices of wrath: brain responses to angry prosody in meaningless speech." *Nature Neuroscience*, vol. 8, 2005.
- Hadjikhani, Nouchine, and Beatrice De Gelder. "Seeing Fearful Body Expressions Activates the Fusiform Cortex and Amygdala." *Current Biology*, vol. 13, no. 24, 2003.
- Henrich, Joseph, and Francisco Gil-White. "The evolution of prestige: Freely conferred deference as a mechanism for enhancing the benefits of cultural transmission." *Evolution and Human Behavior*, vol. 22, no. 3, 2001.
- Hill, R. "Campus values in mate selection." *Journal of Home Economics*, vol. 37, 1945.
- Johnson, Ryan, et al. "Dominance and prestige as differential predictors of aggression and testosterone levels in men." *Evolution and Human Behavior*, vol. 28, no. 5, 2007.
- Li, N., et al. "The necessities and luxuries of mate preferences: testing the tradeoffs." *Journal of Personality and Social Psychology*, vol. 82, no. 6, 2002.
- Li, Yaoran, et al. "Women's Preference for Masculine Traits Is Disrupted by Images of Male-on-Female Aggression." *PLOS One*, Oct. 2014.

- Oliveira, R., et al. *Alternative Reproductive Tactics: An Integrative Approach*. Cambridge University Press, 2008.
- Park, Chris, and Michael Allaby. *Oxford Dictionary of Environment and Conservation*. Oxford University Press, 2017.
- Perez-Babaria, F., et al. "The origins of sexual dimorphism in body size in ungulates." *Evolution*, vol. 56, no. 6, 2002.
- Pourtois, G., et al. "Electrophysiological Correlates of Rapid Spatial Orienting Towards Fearful Faces." *Cerebral Cortex*, vol. 14, no. 6, 2004.
- Provost, Meghan, et al. "Short-term mating strategies and attraction to masculinity in point-light walkers." *Evolution and Human Behavior*, vol. 29, no. 1, 2008.
- Puts, David. "Beauty and the beast: mechanisms of sexual selection in humans." *Evolution and Human Behavior*, vol. 31, no. 3, 2010.
- . "Mating context and menstrual phase affect women's preferences for male voice pitch." *Evolution and Human Behavior*, vol. 26, no. 5, 2005.
- Puts, David, et al. "Masculine voices signal men's threat potential in forager and industrial societies." *Proceedings: Biological Science*, vol. 279, 2012.
- . "Dominance and the evolution of sexual dimorphism in human voice pitch." *Evolution and Human Behavior*, vol. 27, 2006.
- . "Men's voices as dominance signals: vocal fundamental and formant frequencies influence dominance attributions among men." *Evolution and Human Behavior*, vol. 28, 2007.
- Re, Daniel, et al. "Preferences for Very Low and Very High Voice Pitch in Humans." *PLOS One*, 5 Mar. 2012, doi:10.1371/journal.pone.0032719.

- Schmitt, David, and David Buss. "Strategic self-promotion and competitor derogation: Sex and context effects on the perceived effectiveness of mate attraction tactics." *Journal of Personality and Social Psychology*, vol. 70, no. 6, 1996.
- Sugase, Yasuko, et al. "Global and fine information coded by single neurons in the temporal visual cortex." *Nature*, vol. 400, 1999.
- Takanakuy: Fistfighting in the Andes*. Produced by Thomas Morton, Vice, 2012.
- Titze, Ingo, and Roger Chan. "Effect of vocal fold tissue shear properties on phonation threshold pressure in a physical model of the larynx." *The Journal of the Acoustical Society of America*, vol. 107, 2000.
- Vukovic, Jovana, et al. "Variation in perceptions of physical dominance and trustworthiness predicts individual differences in the effect of relationship context on women's preferences for masculine pitch in men's voices." *British Journal of Psychology*, vol. 102, 2011.
- Wolff, Sarah, and David Puts. "Vocal masculinity is a robust dominance signal in men." *Behavioral Ecology and Sociobiology*, vol. 64, no. 10, 2010.

Academic Vita

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The Pennsylvania State University | The Schreyer Honors College

Smeal College of Business

B.S. - Supply Chain Management

Department of Asian Studies

B.A. – Chinese Language & Culture

University Park, PA
Graduating May 2017

PROFESSIONAL EXPERIENCE

Hudson's Bay Company

Summer Supply Chain Intern

Recruited to observe and address aspects of the supply chain that needed improvement

A primary focus on improving the flow-through of cartons in the Wilkes-Barre DC

Responsible for pinpointing failings in:

Communication

Line design

Office/loading dock organization and objectives

Compiled standardized Standard Operating Procedure Reports

Helped implement spreadsheets that helped rectify inefficiencies in the supply chain

Wilkes-Barre, PA

June 2016 – July 2016

Uncle Dave's Homemade Ice Cream

Assistant Manager

- Promoted to Assistant Manager at the start of my third year
- Responsible for organization and acquisition of stock
- Experience with customer service, retail and resolving employee scheduling conflicts
- Suggestion and implementation of operational procedures that helped increase productivity

Doylestown, PA

July 2009 – August 2013

LEADERSHIP EXPERIENCE

Adult Educator – Central PA Institute of Science and Technology

Worked with an adult learner to improve their reading, writing and mathematics skills

Developed individual methods for teaching pattern recognition, grammar, basic and intermediate arithmetic etc.

Kept track of the learner's developing skills, and adapted new lessons to match their skill sets

Pleasant Gap, PA

Jan 2016 – May 2016

RELEVANT EXPERIENCE

Finance 301H – Business Plan

Team Member

- Developed a full business plan for a start-up State College company
- Worked with a team of 11 to develop financial, managerial and day-to-day operative best practices
- Experience with financial equations as well as entrepreneurial basics

State College, PA

Jan 2015 – May 2015

SKILLS / INTERESTS / AWARDS

- 3.5 years of experience speaking Mandarin Chinese
 - English teacher at the Jinding Migrant School in Shanghai
- Basic Russian