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Do Women Prefer Men with Masculine Faces *and* Voices, and if so, Why?

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by

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ABSTRACT

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There are competing hypotheses regarding the nature of information in multiple sexually selected traits in humans: the Redundant Signal Hypothesis (RSH), which argues they contain the same information, and the Multiple Message Hypothesis (MMH) argues they signal different information. Theory explaining why multiple traits evolved is lacking; male intrasexual competition may answer this question; evidence for pathogen-mediated sexual selection also exists. This thesis aims to explain the nature of information and why they evolved. The study manipulated facial and vocal masculinity orthogonally and concurrently. Women preferred men with high masculinity faces as short- and long-term potential mates, in terms of fighting ability, health and masculinity. Small main effects for vocal masculinity were found. These findings provided modest support for the RSH and MMH in an interaction between facial and vocal masculinity on fighting ability. Males low on facial and vocal masculinity were judged particularly low. There was also evidence increasingly unrestricted socio-sexuality was associated with increased preferences for facial masculinity.

Do Women Prefer Men with Masculine Faces *and* Voices, and if so Why?

Traditionally, questions regarding interpersonal attraction and nonverbal communication have been examined in the field of Communication have focused on intent, shared meaning, awareness, and units qualified as meaningful. Much of this research has examined nonverbal communication as being "norm-governed" and influenced by culture and environmental variables (Burgoon, 1980). To date, research examining nonverbal and interpersonal attraction viewed through an evolutionary theoretical lens within the field of Communication is lacking. The present thesis aims to examine questions of interpersonal attraction and nonverbal behaviors through an evolutionary theoretical lens. Doing so leads to several new questions about human communication that would not otherwise be asked.

Sexual Selection Theory

Darwin (1859) was troubled by traits that were seemingly inconsistent with his theory of evolution by natural selection. Naturally selected traits are adaptations (such as eyes, teeth, muscles, and organs) that solve specific adaptive problems (eyes are for seeing, hearts are for moving blood around the body). Naturally selected traits are characteristically efficient, modular, and essentially the same in all individuals that go through normal development. Traits such as peacocks' tails and elks' antlers are clearly not naturally selected. The peacock's tail, for example, is conspicuously large, metabolically costly, and does not solve an adaptive function connected directly to survival (in fact, it probably decreases the odds of survival by impeding the ability to elude and escape predators). Darwin (1871) devised his theory of evolution by sexual selection to explain traits like the peacock's tail. Traits are sexually selected when they give individuals advantages in reproduction that overcome any fitness costs associated with developing, bearing, or using those traits. Sexually selected traits, unlike naturally selected traits, are costly, conspicuous, highly individually variable,

and non-modular. Sexual selection produces two kinds of traits, ornaments (such as calls, bright plumage, ritual behaviors) which are used to attract members of the opposite sex, and armaments (such as large muscles, teeth, antlers) which are used to compete with other members of the same sex for access to mates (usually males compete for access to females). Despite much early skepticism, sexual selection theory is now a foundation of modern biology (see Andersson, 1994), and has produced the most evolutionary science on humans (see Miller, 2001).

The aim of selecting a partner for sexual reproduction is largely focused on gaining access to good genes (e.g., for high heritable fitness in general), as half of the offspring's genes come from the other parent. It is hypothesized that ornaments communicate information about genetic quality to potential mates. For example, the peacock with the brightest plumage communicates his genetic quality to potential mates (Loyau, et al., 2007). Males vary in quality, and only those males that can afford the most elaborate plumage can afford the metabolic and other costs, thus making the signal honest (i.e., not easily faked). While this part of sexual selection is well understood (see the section on sexual selection and signals below), there remain important questions regarding the multi-channel nature of sexually selected ornaments. Peacocks, for example, have elaborate tail feathers, iridescent breast feathers, a crest of feathers on their heads, loud mating calls, and a complex display ritual. If sexually selected ornaments communicate information about quality, then why doesn't one ornament suffice?

If multi-channel ornaments are sexually selected adaptations, receivers must have adaptations for processing the information contained in those adaptations. For instance, female pigeons (*Columba livia*) respond more to multisensory (audio/visual) channels of male courtship behavior than either channel alone (Partan, Yelda, Price & Shimizu, 2004).

Similarly, humans have multiple ornaments used in mate selection. For example, men prefer women with a low waist-to-hip ratio (Jasieńska, Ziomkiewicz, Ellison, Lipson & Thune, 2004), higher pitched voices (Feinberg, et al., 2005), full lips, small noses and jaws (Little, Jones, DeBruine, 2011), and odors indicative of fertility (Wedekind & Füri, 1997). Further, women prefer males with relatively high facial and vocal masculinity when searching for short-term mates, particularly when in their fertile phase (e.g., Feinberg, et al, 2006; Feinberg, DeBruine, Jones & Little, 2008), greater height, intelligence, and odors indicative of Testosterone (T) (Gildersleeve, Haselton, & Fales, 2014).

Several hypotheses regarding the complex, multi-channel nature of sexually selected ornaments have been proposed (see Johnstone, 1996; Møller & Pomiankowski, 1993). I consider two prominent hypotheses in this thesis. Per the Redundant Signaling Hypothesis (RSH; aka. the "backup signal" hypothesis), additional displays enhance the accuracy with which signalers assess a single quality. If this is true, then individuals who signal intensely on two (or more) channels should be preferred as potential mates compared to individuals who signal intensely on only one channel. Per the Multiple Message Hypothesis (MMH), different traits signal different qualities. If the MMH is true, then signals across different channels will independently affect different domains of assessment (e.g., health vs. fighting ability).

Previous research has established that women prefer more masculine male faces and voices—a marker for T—when considering males as short-term sexual partners. However, research has not considered how masculinity (and other) judgments of men on these two channels are integrated. The redundant signaling hypothesis and the multiple message hypothesis make different predictions regarding how this problem is solved. The first aim of this thesis is to test whether the redundant signaling hypothesis or the multiple message

hypothesis best account for the functioning of these channels in men.

But what selects for multiple channels of sexual ornamentation? Research shows that women who are higher on pathogen disgust or who are exposed to pathogen priming stimuli prefer greater masculinity in male faces, voices, and bodies (DeBruine, Jones, Tybur, Lieberman, & Griskevicius, 2010; Little, DeBruine, & Jones, 2011; Jones, Feinberg, Watkins, Fincher, Little, & DeBruine, 2012). Other research (e.g., Puts, Jones, & DeBruine, 2012) suggests that male intrasexual competition has had a stronger selective pressure on male secondary sexual characteristics than female choice, and that masculinity in both male faces and voices are largely a function of this competition. Importantly, however, researchers have not considered the combination of facial and vocal masculinity and whether the combination, or a single trait, is more strongly correlated with pathogen disgust or intrasexual competition. Finding the answer is important because this would provide us with information regarding the possible selective pressures for the multiple sources of masculinity in male faces and voices. Thus, the second aim of this thesis is to test whether pathogen-mediated sexual selection and/or male intrasexual competition can account for the evolution of combinations of male facial and vocal masculinity.

Sexual Selection and Signaling

Sexually selected ornaments contain hidden information that is useful in mate choice. A crucial feature of this information content is that it must be reliable (i.e., it must honestly communicate true information about the individual) for it to evolve. If the information content of sexually selected ornaments were not reliable, traits could not evolve because receivers would not be able to distinguish between low and high quality mates. Over time receivers would evolve to ignore unreliable traits, and those traits would disappear from the population. Biologists define this reliable information content found in naturally and sexually

selected traits as "signals." Maynard Smith and Harper (2003) provide a definition for signals: "We define a 'signal' as any act or structure which alters the behavior of other organisms, which evolved because of that effect, and which is effective because the receiver's response has also evolved" (p. 3). Signals are valuable to both signalers and receivers because they promote fitness for both parties. In the case of sexually selected traits, signalers benefit by being selected as mates, and receivers benefit from selecting the best quality mate that they can.[1]

Signal honesty is promoted by signal cost (Zahavi & Zahavi, 1997). This idea was first elaborated as a verbal argument by Zahavi in the handicap principle. According to Zahavi, the reason that sexually selected ornaments are conspicuous and individually variable is precisely *because* they are costly. Sexually selected ornaments are handicaps because only higher quality individuals can afford the costs of elaborate sexually selected traits. The costs of a very large tail for a low-quality peacock are intolerable (e.g., to survival). Females are able to accurately assess which males are better mates because sexually selected traits are reliably correlated with quality. This system "motivates" all individuals to signal at the highest level of intensity that they can afford, because doing so advertises their quality to potential mates by outcompeting lesser rivals. Zahavi's handicap principle has since been mathematically formalized by Grafen (1990), extended to naturally selected traits (e.g., begging and alarm calls), and has become the cornerstone of research on the biological study of animal communication (see Searcy & Nowicki, 2005; Maynard Smith & Harper, 2003).

The Redundant Signal Hypothesis

Biologists have attempted to explain why some species have multiple sexually selected ornaments, whereas others have few or only one. Møller and Pomiankowski (1993) proposed three hypotheses.[3] The redundant signaling hypothesis (RSH) states that a single

trait can only provide partial information about overall condition or quality.[2] Thus, receivers pay attention to each trait to gain an overall assessment of quality. The hypothesis can be understood as analogous to factor analysis. A latent factor, genetic quality, is represented by multiple independent 'indicators' (here signals, communicated through vocal displays and secondary sexual characteristics like musculature), which collectively explain more variance than any single indicator. Because any single trait provides only a partial representation of the individual's condition, receivers form a better estimate of condition by considering multiple traits together.

If the RSH is true, then several predictions follow. First, masculine faces and voices should both positively correlate with quality, but the intensity of the signals should only be modestly intercorrelated across individuals. If the traits were too highly intercorrelated, they would not provide the needed independent information about quality. Further, if multiple signals provide more information than individual signals, we should find that receivers express more confident judgments about mate quality (at whatever level that happens to be) by considering multiple signals than individual signals. As a corollary, we would also expect that interest in multiple signals is greater than interest in individual signals. Finally, individuals that are attractive on multiple traits will be a good deal more desirable than individuals that are attractive on only a single trait (or individuals who are low on all traits will be particularly unattractive).

There is relatively little research on the RSH in humans. While there is some evidence for the hypothesis in women,[4] there is less research on correlated secondary sexual characteristics in men, and the findings are also mixed. Feinberg, et al., (2008) conducted an experiment in which six male faces and six male voices were manipulated on levels of masculinity. Participants were presented with audio and visual stimuli in separate blocks, and

given a forced-choice task (i.e., they were instructed to choose the face or voice they preferred from a set of two). Their findings indicated that women's preferences for vocal masculinity were consistent, while preferences for facial masculinity were inconsistent. Only women not taking hormonal contraceptives exhibited correlated preferences for facial and vocal masculinity. Clearly, further research examining correlated traits in men, and individual differences in female judges, is warranted. Given that assessment of facial and vocal masculinity have been assessed independently, in the current study they will be assessed concurrently. If the RSH is correct, then (H1): Men who are high on both facial and vocal masculinity will be judged as more desirable mates by women than men who are highly masculine in either faces or voices, and men who are low on both facial and vocal masculinity will judged as particularly unattractive.

The Multiple Message Hypothesis

According to the MMH (Møller and Pomiankowski, 1993) different secondary sexual characteristics signal different pieces of information about quality. For example, one ornament might signal information about current health while others signal information about immunocompetence or fighting ability. It is also possible that different ornaments provide information over different time scales. Many secondary sexual characteristics are developed prior to a mating season, and probably reflect the condition of the animal leading up to that phase. Other ornaments, however, may indicate information about quality overall, relatively independent of time frame.

Research shows that men with more masculine faces and voices are judged more attractive by women as short-term mates, and by both men and women as physically and/or socially dominant.[5] While there is evidence that female choice has exerted pressure on the evolution of male facial and vocal masculinity, when the size of the effect is compared to that

on judgments of male dominance, it is the latter that wins out (see Puts et al., 2012; Puts, Apicella, & Cárdenas, 2011; Puts, Hodges, Cárdenas, & Gaulin, 2007). In other words, women find more masculine faces and voices more attractive up to a point (the relationship is curvilinear), but there is a stronger, linear relationship between facial and vocal masculinity and judgments of dominance (e.g., fighting ability). This observation has led Puts and colleagues to conclude that male intrasexual competition has been a stronger selection pressure on male faces and voices than female choice.

However, once again, researchers have considered the effects of masculinity of faces and voices independently rather than in combination. If it is true that facial and vocal masculinity were selected by both female choice and male intrasexual competition, it is possible that facial and vocal masculinity indicate different pieces of information. For example, when considered simultaneously, it may be that one provides more information about fighting ability, while the other provides more information about current health. As such, simultaneous presentation of facial and vocal variations in masculinity should be correlated with judgments of sexual attractiveness (both short- and long-term attractiveness), masculinity/fighting ability, and current health. If the multiple message hypothesis is true, then we should find that faces and voices have differential impacts on these judgments. Thus (H2): High versus low masculinity in faces versus voices will be differentially correlated with assessments of males as short- versus long-term mates, fighting ability, health, and masculinity. The MMH does not specify *a priori* what the particularly pattern of correlations ought to be, only that there should be different messages contained in faces and voices.

Selective Pressures on Male Facial and Vocal Masculinity

The RSH and the MMH both generate predictions about signal content, but they do

not specify the selective pressures that produced masculinity in male faces and voices. However, the RSH and/or MMH should combine with research on selective pressures to build a more general picture of the evolution of male facial and vocal masculinity. I consider three hypotheses.

Male Intrasexual Competition

As noted, Puts and colleagues (e.g., Puts et al., 2007; 2011; 2012) have argued that male facial and vocal masculinity have been selected by a combination of female choice and male intrasexual competition, with the primary selective pressure being male competition. If true, then we should find that combinations of high facial and vocal masculinity are most preferred by women who are judging men as short-term sexual partners. The reason for this is that men who are best able to compete with rivals will be most likely to produce viable offspring who are themselves highly able in intrasexual competition. Thus, H3: Women who tend towards a more un-restricted socio-sexuality (i.e., women who are more likely to engage in short-term sexual strategizing) should be those who most prefer males with the highest combination of facial and vocal masculinity.

Similarly, the life history strategy that women pursue should affect preferences for male masculinity. According to life history theory (see Kaplan & Gangestad, 2005), people have a finite budget of energetic resources to spend across the life span, and this leads to trade-offs in how a budget might be best spent. The theory assumes that trade-offs that best maximize fitness are those that are selected. A fundamental trade-off is between present and future reproduction. When life expectancy is curtailed (e.g., because of unpredictable food supply; warfare; disease) life history strategy speeds up, and people spend more effort on current than future reproduction. This "live fast, die young" strategy produces social competition, aggression, risk taking, and early reproduction. When life is relatively stable

and predictable, however, life history strategy slows. In this case, it is better to invest in the future, and the quality of offspring. In this "live long, die old" strategy, more effort is placed on cooperation, low aggression, risk aversion, and late reproduction.

If life history theory is correct, then women who pursue faster life history strategies should have a stronger preference for masculinity in males. Such men are best able to outcompete rivals, and produce offspring who are themselves well prepared for intense intrasexual competition. Indeed, research has shown that life history strategy is correlated with sociosexuality. Women with relatively unrestricted sociosexuality (i.e., those women who report more sexual partners and more openness to short-term sexual partners) are more likely to pursue a fast life history strategy (Kruger & Fisher, 2008). Thus, H4: Women with faster life history strategies will have a stronger preference for high- over low-masculinity in male faces and voices.

Parasite Mediated Sexual Selection

Research suggests that facial and vocal masculinity have been selected because these secondary sexual characteristics are proximally caused by T, which is immunosuppressant. As such, high facial and vocal masculinity are costly signals of immune quality. This suggests that men who are highest on the combination of facial and vocal masculinity would be most strongly preferred by women who most value pathogen avoidance (i.e., women who are relatively "germ phobic") because they prefer mates with the best quality immune systems.

There is a substantial body of evidence in favor of the pathogen-mediated sexual selection hypothesis. Studies have shown that independent preferences for facial and vocal masculinity are greater among women who are high in pathogen disgust sensitivity (Little, DeBruine, & Jones, 2011; DeBruine, Jones, Tyber, Lieberman, & Griskevicius, 2010; Jones,

Feinberg, Watkins, Fincher, Little, & DeBruine, 2012). Research in this domain has previously used both manipulated masculinity (Little, DeBruine, & Jones, 2011) and naturally occurring masculinity (e.g., DeBruine, et al., 2010). Findings are consistent across studies that pathogen disgust is positively correlated with women's preferences for masculinity in men (DeBruine, et al., 2010; Jones, et al., 2012), health cues in potential mates (Jones, et al., 2012), and preferences for symmetry in faces are also moderated by pathogen cues (Little, DeBruine, & Jones, 2011), regardless of whether a visual pathogen prime was incorporated into the study design (e.g., Little, DeBruine, & Jones, 2011) or not. That these findings were replicated in studies utilizing both artificially manipulated stimuli and unmanipulated stimuli (DeBruine, et al., 2010) rules out extraneous factors, and provides evidence that women's preferences for masculinity in men are affected by pathogen sensitivities. However, studies have not examining the concurrent presentation of facial and vocal masculinity. Thus, H5: Women who are higher in pathogen disgust will have a stronger preference for high over low masculinity men.

Method

Participants and Design

The current research examines how facial and vocal masculinity combine in a correlational study. Women were exposed to photographs and voice recordings of 12 men who fell into a 2(Facial Masculinity: High/Low) x 2(Vocal Masculinity: High/Low) repeated measures design. Women judged the men on short- and long-term sexual attractiveness, fighting ability, health, and masculinity. After these judgments were made, participants provided demographic information, as well as measures of pathogen disgust and socio-sexual orientation.

Participants ($N = 47$) were recruited from the undergraduate subject pool in the

Department of Communication at the University of California, Santa Barbara via a purposive sampling technique. Eligibility for participation was dependent upon being female and heterosexual. Three women indicated being bisexual and one homosexual, leaving $N = 43$. While this sample is relatively small for typical social science studies, the effect sizes of facial and vocal masculinity on these dependent measures are of medium to large size, and relatively high statistical power is gained by using a repeated measures design and multi-level modeling.

Stimuli

A total of 34 photos and 34 audio recordings were selected from stimuli collected from male participants in a previous study with permission for future use. From this sample, stimuli were selected that met the design criteria for combinations of relatively low and high facial and vocal masculinity, and that were all ethnically Caucasian in appearance. Photos were of targets with a neutral facial expression consistent with previous research (e.g., Rhodes, Chan, Zebrowitz, & Simmons, 2003), a blank background, and in color (see Appendix A for examples). Audio recordings were of the men counting from one to five.

Procedures and Measures

The study was conducted on computers using Qualtrics software. Participants were presented with 12 pairs of photos and audio recordings and asked to provide their judgments after having looked at the pictures and listened to the vocal recordings. Participants rated the stimuli on short- and long-term attractiveness, ability to win fights, health, and masculinity. Participants also completed a measure of socio-sexuality (SOI-R; Penke & Asendorpf, 2008).

Short- and long-term attractiveness, perceived masculinity and health, and ability to win fights were all measured on 7-point Likert scales with *1* being "*not at all*" and *7* being "*extremely*". For example, long-term attractiveness was measured with a single item: "*How*

attractive is this person for a long-term, committed relationship?". Ability to win fights was measured with a single item, "*How likely is it that this man would win a fight with an average man his age?".* (See Appendix B for full measures).

Demographic data collected from participants consisted of age, sexual orientation, ethnicity, biological sex, and current relationship status. Participants were then asked to complete the 9-item SOI-R (Penke & Asendorpf, 2008). The first six items of the SOI-R are closed-ended and pertain to sexual history; e.g., "*With how many different partners have you had sex within the past 12 months?*". The final three items are measured on a 9-point Likert-type scale and pertain to sexual desires; e.g., "*How often do you fantasize about having sex with someone you are* not *in a committed relationship with?*". The SOI-R measure was reliable ($\alpha = .85$). Higher numbers on the SOI-R indicate a more unrestricted orientation that entails greater openness to short-term sexual relations.

Life history strategy was measured using Figueredo et al.,'s (2014) mini-K measure. This 20-item scale (-3 *disagree strongly*; 3 *agree strongly*) contains items regarding risk taking (e.g., *I avoid taking risks*), persistence on problems (e.g., *I don't give up until I solve my problems*), and relational connections (e.g., *I often get emotional support and practical help from my blood relatives*). The scale was reliable ($\alpha = .82$). Higher scores represent a slower life history strategy.

Individual differences in disgust sensitivity were assessed using Tybur, Lieberman, and Griskevicius' (2009) three-domain measure of disgust (0 *not at all disgusting*; 6 *extremely disgusting*). Moral disgust (e.g., *shoplifting a candy bar from a convenience store; a student cheating to get good grades*), sexual disgust (e.g., *performing oral sex; watching a pornographic video*), and pathogen disgust (e.g., *stepping on dog poop; accidentally touching a person's bloody cut*) are correlated but distinct domains. Sub-scales for moral ($\alpha =$

.88), sexual (α = .76), and pathogen disgust (α = .83) were reliable.

Results

Hypothesis testing was undertaken using Hierarchical (aka. multi-level) Linear Modeling (HLM). The HLM approach has advantages over the General Linear Model (GLM). The GLM assumes that repeated measures are independent observations. Violations of this assumption typically inflate Type I error rates, and this is likely whenever repeated measures are positively intercorrelated. Given that the repeated measures in this study are positively correlated, the independence assumption is violated. The HLM approach deals with non-independence by including a random variable for variation among judgments nested within participants. The HLM approach has the additional advantage that it produces accurate parameter estimates when there is missing data. The HLM approach also has good statistical power because multiple observations are nested within participants. In this study 43 participants judged 12 male targets for a total of 516 observations per variable. Degrees of freedom are estimated for each model using an iterative procedure, so fractional degrees of freedom are possible, as are variations in degrees of freedom across analyses. Degrees of freedom are rounded to the nearest whole number. However, the interpretation of main effects and interactions are the same as in the GLM. Maximum likelihood estimation was employed throughout. Means, standard deviations, and inter-correlations are presented in Table 1.

Tests of Hypothesis 1 and 2: Redundant Signaling or Multiple Messages?

Under H1, the RSH, it was predicted that facial and vocal masculinity would interact on judgments of sexual attraction. Specifically, combinations of high or low facial and vocal masculinity would be judged more extremely than other combinations. On the other hand, under H2, the MMH, it was predicted that facial and vocal masculinity would not interact,

Table 1. Means, Standard Deviations, and Inter-correlations

	M	SD	1	2	3	4	5	6	7	8	9	10
1. Short-term	3.05	.89	__	.93***	.77***	.70**	.64***	-.07	-.07	.25	-.04	-.05
2. Long-term	3.01	.95		__	.77***	.69***	.65***	-09	-.03	-.21	.05	.02
3. Fighting	3.47	.68			__	.81***	.85***	.06	-.16	-.17	-.02	.07
4. Health	3.85	.72				__	.83***	-.11	-.08	-17	.02	.04
5. Masculinity	3.73	.74					__	.01	.04	-.21	-.07	.02
6. SOI-R	3.66	1.51						__	-.22	.05	-.34*	.02
7. Mini-K	5.51	.66							__	.02	.14	.03
8. Pathogens	5.22	1.06								__	.57***	.44***
9. Sex	4.26	1.12									__	.58***
10. Morality	4.73	1.20										__

but that they would predict different aspects of quality (although what those would be was not specified).

H1 and H2 were tested using a HLM with 2(Facial Masculinity: High/Low) by 2(Vocal Masculinity: High/Low) and judgments of targets included long- and short-term sexual attraction, fighting ability, health, and masculinity. Means are presented in Table 2, and the main effects and interactions are summarized in Table 3.

Table 2. *Mean evaluations of men who varied in facial and vocal masculinity across judgment domains.*

	Facial Masculinity			
	High		Low	
Vocal Masculinity	High	Low	High	Low
Short-term attraction	3.79	3.63	2.66	2.22
Long-term attraction	3.71	3.45	2.62	2.41
Fighting ability	4.27	3.94	3.29	2.50
Health	4.39	4.15	3.62	3.37
Masculinity	4.63	4.14	3.53	2.74

Table 3. *F-statistics for Tests of H1 and H2 comparing Redundant Signaling and Multiple Message hypotheses. The ratio column refers to the ratio of F statistics for facial*

masculinity versus vocal masculinity main effects.

	Source of Variance			
	Facial Masculinity	Vocal Masculinity	Interaction	Ratio
Short-term	116.69 ***	6.26 *	1.40	18.64
Long-term	99.35 ***	4.96 *	.07	20.03
Fighting	144.51***	30.78 ***	5.34*	4.69
Health	75.51 ***	7.27 **	.002	10.39
Masculinity	116.59***	6.26 *	1.40	18.62

*$p < .05$; **$p < .01$; ***$p < .001$.

As can be seen in Tables 1 and 2, there is relatively little confirmation of H1 as there is only one significant interaction. For short-term attraction, there were main effects for facial masculinity, $F(1, 474) = 116.69$, $p < .001$, and vocal masculinity, $F(1,474) = 6.26$, $p = .016$,

but no evidence for an interaction, $F(1,474) = 1.40$, $p = .24$. Men with high facial masculinity were judged much more favorably as short-term sexual partners than men with low facial masculinity, and there was also a small main effect in which men with high vocal masculinity were judged more favorably than men with low vocal masculinity.

For long-term attraction, there were main effects for facial masculinity, $F(1, 474) = 99.35$, $p < .001$, and vocal masculinity, $F(1,474) = 4.96$, $p = .026$, but no evidence for an interaction, $F(1,474) = .07$, $p = .80$. The pattern of judgments was the same as that found for short-term sexual attraction.

For fighting ability there was some evidence for H1. There was a strong main effect for facial masculinity, $F(1, 475) = 144.51$, $p < .001$, and vocal masculinity, $F(1,475) = 30.78$, $p < .001$, and a small interaction, $F(1,475) = 5.34$, $p = .02$. Consistent with the redundant signaling hypothesis, men who were low in both facial and vocal masculinity were judged the least likely to prevail in a fight with someone their age.

For judgments of health there were main effects for facial masculinity, $F(1, 475) = 75.51$, $p < .001$, and vocal masculinity, $F(1,475) = 7.27$, $p = .007$, but no evidence for an interaction, $F(1,475) = .002$, $p = .97$. Men higher in masculinity were judged as healthier.

Finally, for judgments of masculinity there were main effects for facial masculinity, $F(1, 475) = 116.59$, $p < .001$, and vocal masculinity, $F(1,474) = 6.26$, $p = .013$, but no evidence for an interaction, $F(1,474) = 1.40$, $p = .24$. Men with higher facial and vocal masculinity were judged higher on masculinity.

There is relatively little evidence for both H1 and H2. The redundant signaling hypothesis was confirmed only on fighting ability, whereas if the hypothesis were true, there should have been evidence of an interaction on attraction ratings, as this is the summary judgment that ought to be calculated by women by integrating information about both faces

and voices. There is also relatively little evidence for the multiple message hypothesis, which predicted that facial and vocal masculinity would predict different outcomes. Instead, facial and vocal masculinity had additive effects on all outcomes, except for fighting ability. Together these findings suggest that fighting ability may be the one place where the voice provides different information than facial masculinity, thus also providing partial evidence for the MMH.

Finally, it is worth noting that the effect sizes for facial and vocal masculinity show that faces matter considerably more across judgments. Taking the ratio of the *F*-statistics for main effects of facial and vocal masculinity provide an estimate of the ratio in the effect sizes. For short-term attraction effect size of facial masculinity was 18.63 larger than vocal masculinity. For long-term attraction, the ratio was 20.03 times, for fighting ability it was only 4.69 times, for health it was 10.39 times, and for masculinity it was 18.62 times. These findings show that except for judgments of fighting ability, facial masculinity is considerably more heavily weighted in judgments than vocal masculinity.

Tests of H3, H4 and H5: Male Intrasexual Competition and Pathogen-Mediated Sexual Selection as Selective Pressures

It was predicted that if the selective pressures for high facial and vocal masculinity are based on male intrasexual competition, then under H3 women who have unrestricted socio-sexualities and/or H4 fast life history strategies will be most attracted to males with the highest combination of facial and vocal masculinity. In other words, women with a stronger preference for high male masculinity would prefer them as mates because they tend to be the ones most likely to prevail in competition with other men. Given that there was little evidence for the redundant signaling hypothesis, and strong evidence that faces contribute most strongly to judgments, it is expected that life history strategy and/or socio-sexual

orientation will interact primarily with facial masculinity. Under H4, however, it was predicted that increases in pathogen disgust would be associated with a greater preference for high than low male masculinity. Again, because of the lack of evidence for redundant signaling, it is more likely that pathogen disgust will interact with facial masculinity rather than vocal masculinity, as faces evidently contain more information regarding male quality than voices.

It is important to note that H3, H4, and H5 are not mutually exclusive. It is possible that pathogen avoidance mechanisms have selected for masculinity in long-term mates, and that fast life history strategies have selected for masculinity in short-term mates. Both processes could concurrently select for higher testosterone (and thus masculinity) in men.

To test H3, H4, and H5 several HLMs were fitted in which life history strategy, SOI, and pathogen disgust were moderators of the effects of facial and vocal masculinity on judgments of male targets. In these models interaction terms were specified for the moderator and facial and vocal masculinity, but no interactions were specified among moderators (i.e., no interactions among SOI, life history strategy, or pathogen stress). This model was tested, in turn, for each of the five dependent measures. The moderators are continuous variables and they were grand-mean centered.

On short-term sexual attraction, the HLM showed the same main effects for facial and vocal masculinity described above, but it added evidence for interactions between facial masculinity and SOI, $F(1,451) = 10.94$, $p = .001$, and between facial masculinity and life history strategy, $F(1,451) = 4.14$, $p = .043$. There was no evidence for an interaction involving pathogen disgust. As can be seen in *Figure 1*, as socio-sexual orientation becomes increasingly unrestricted, women's short-term preference for men with high over low masculinity faces increases. Similarly, as can be seen in *Figure 2*, as life history strategy

becomes slower, women's short-term preference for men with high over low masculinity faces increases. These findings confirm H3, but disconfirm H4.

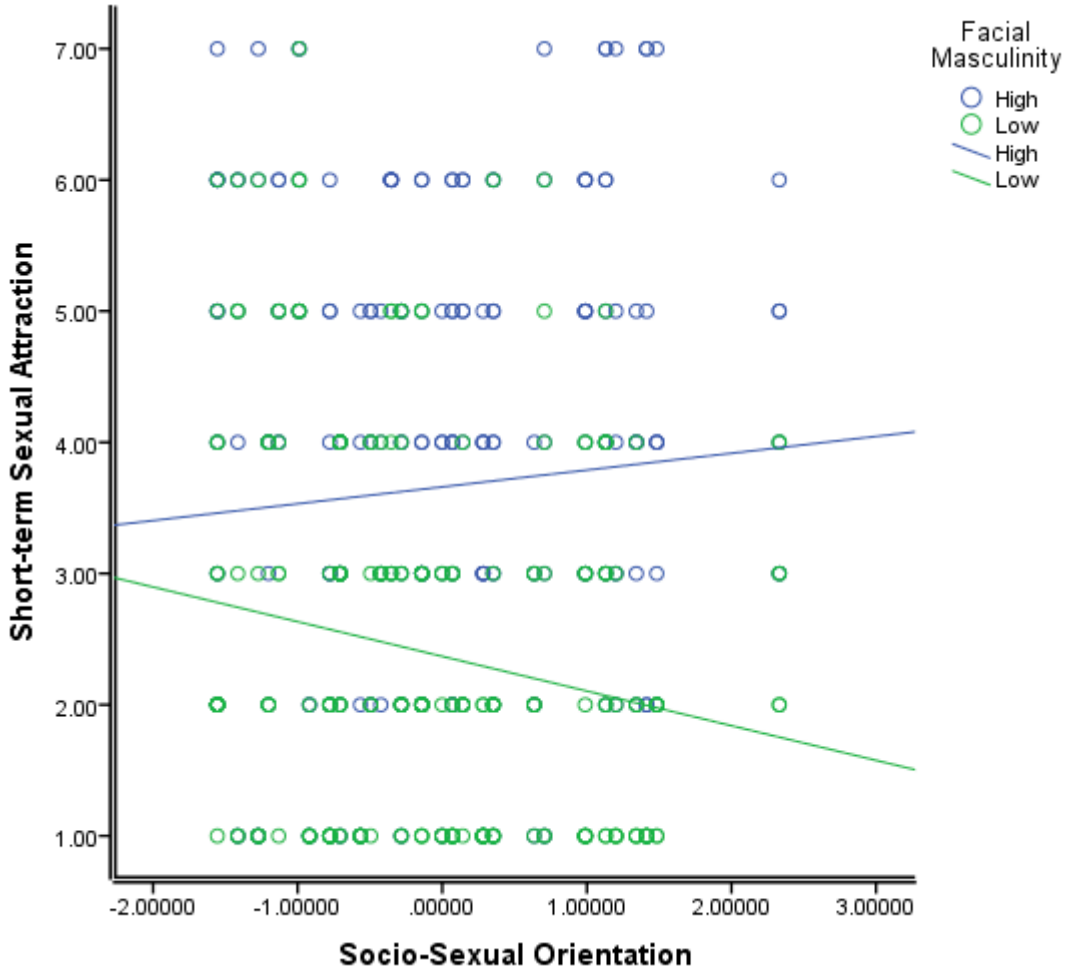

Figure 1. Socio-sexual orientation and women's short-term preferences.

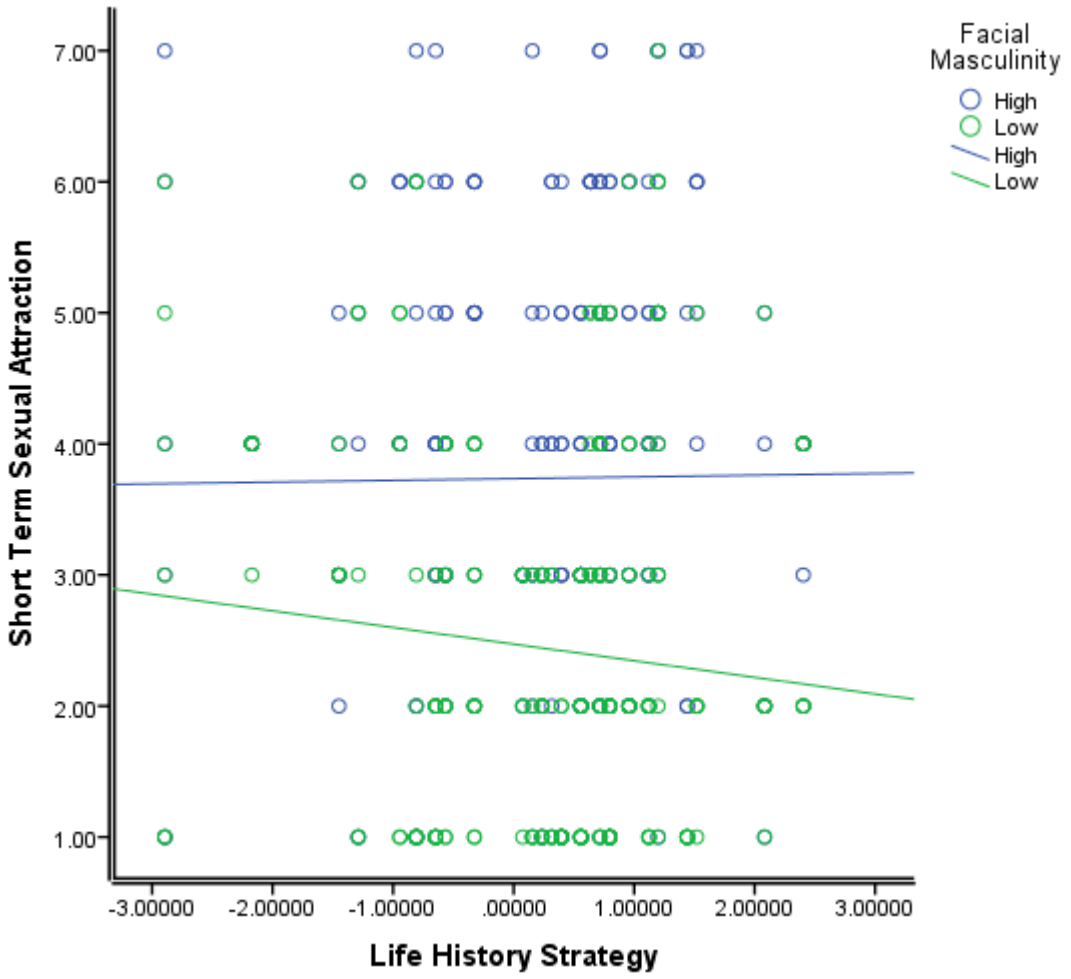

Figure 2. Life History Strategy and women's short-term preferences.

On long-term sexual attraction, the HLM showed the same main effects for facial and vocal masculinity described above, but it added evidence for interactions between facial masculinity and SOI, $F(1,451) = 19.78$, $p < .001$, and between facial masculinity and life history strategy, $F(1,451) = 3.88$, $p = .049$. There was no evidence for an interaction involving pathogen disgust. As can be seen in *Figure 3*, as socio-sexual orientation becomes increasingly unrestricted, women's long-term attraction preference for men with high over low masculinity faces increases. Similarly, as can be seen in *Figure 4*, as life history strategy becomes slower, women's long-term attraction preference for men with high over low

masculinity faces increases. These findings confirm H3.

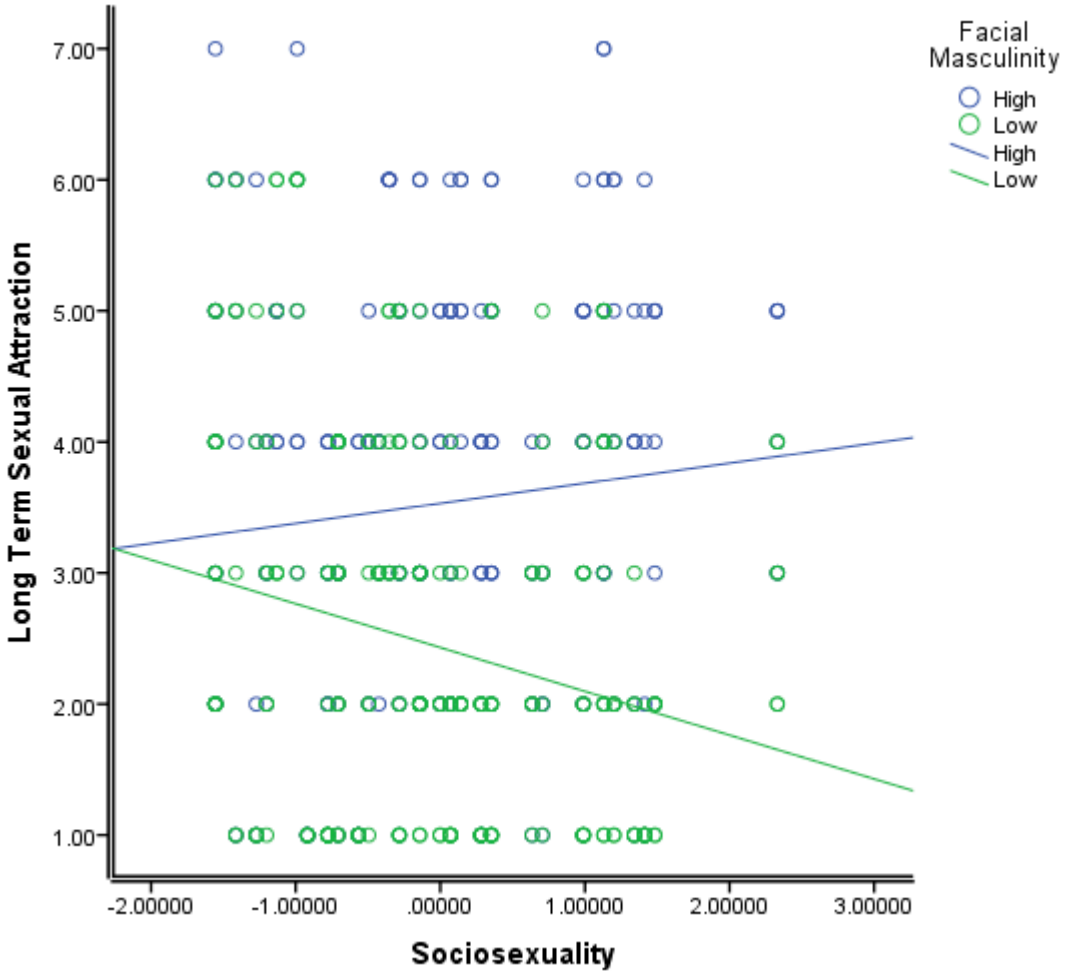

Figure 3. Socio-sexual orientation and women's long-term preferences.

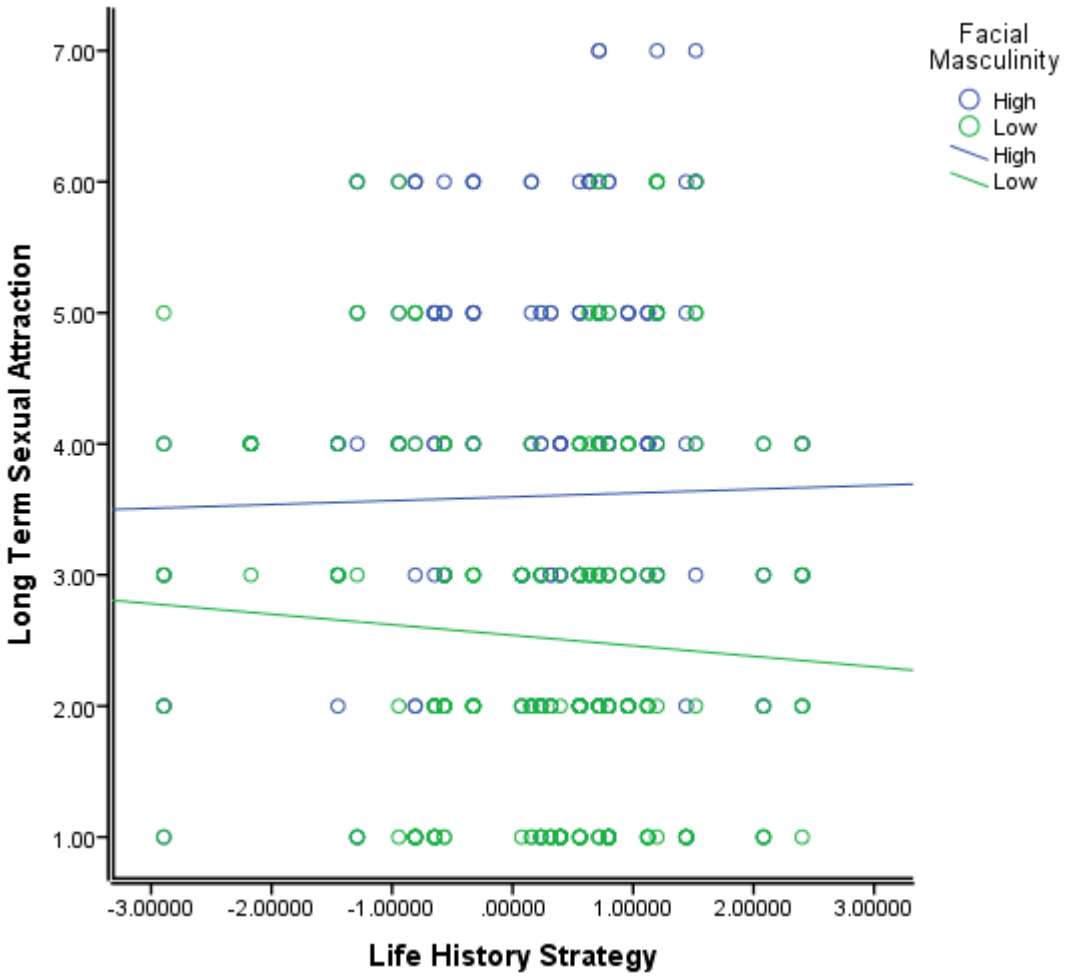

Figure 4. Life History Strategy and women's long-term preferences.

On estimates of fighting ability, the HLM replicated the main effects for facial and vocal masculinity, as well as the facial by vocal masculinity interaction. However, there was also evidence for an interaction between facial masculinity and pathogen disgust, $F(1,451) = 7.29$, $p = .007$. There was no evidence for any other significant effects. As can be seen in *Figure 5*, as pathogen disgust increases, there is no evidence for effect on the judgments of the fighting ability of men with highly masculine faces, but there is a decreasing estimate of the ability of men with low masculinity faces to win fights. These findings are consistent with H4.

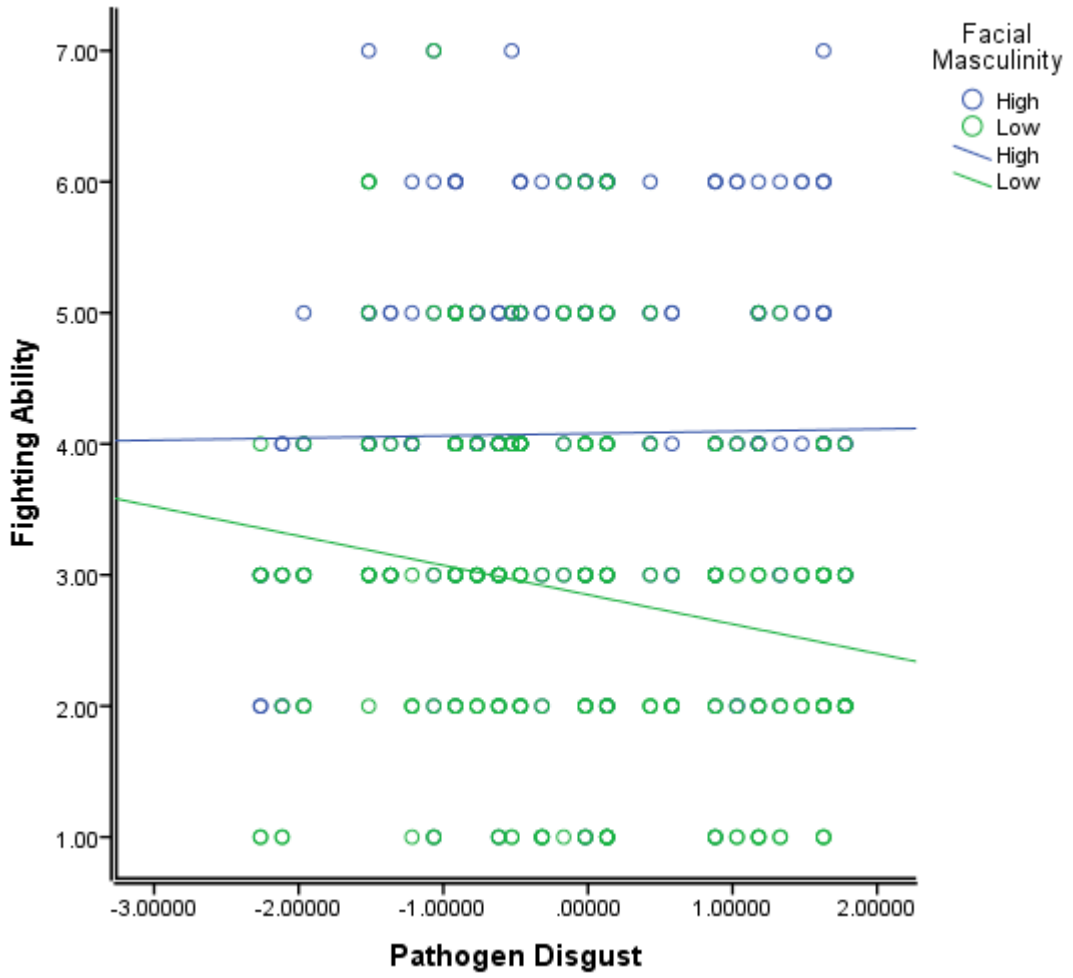

Figure 5. Pathogen disgust and judgments of fighting ability.

On judgments of the health of men the HLM replicated the main effects of facial and vocal masculinity. It also provided evidence for an interaction between vocal masculinity and SOI, $F(1,451) = 4.75$, $p = .03$. As seen in *Figure 6*, as life history strategy speeds up, the judgments of greater health in high over low masculinity males faces increases.

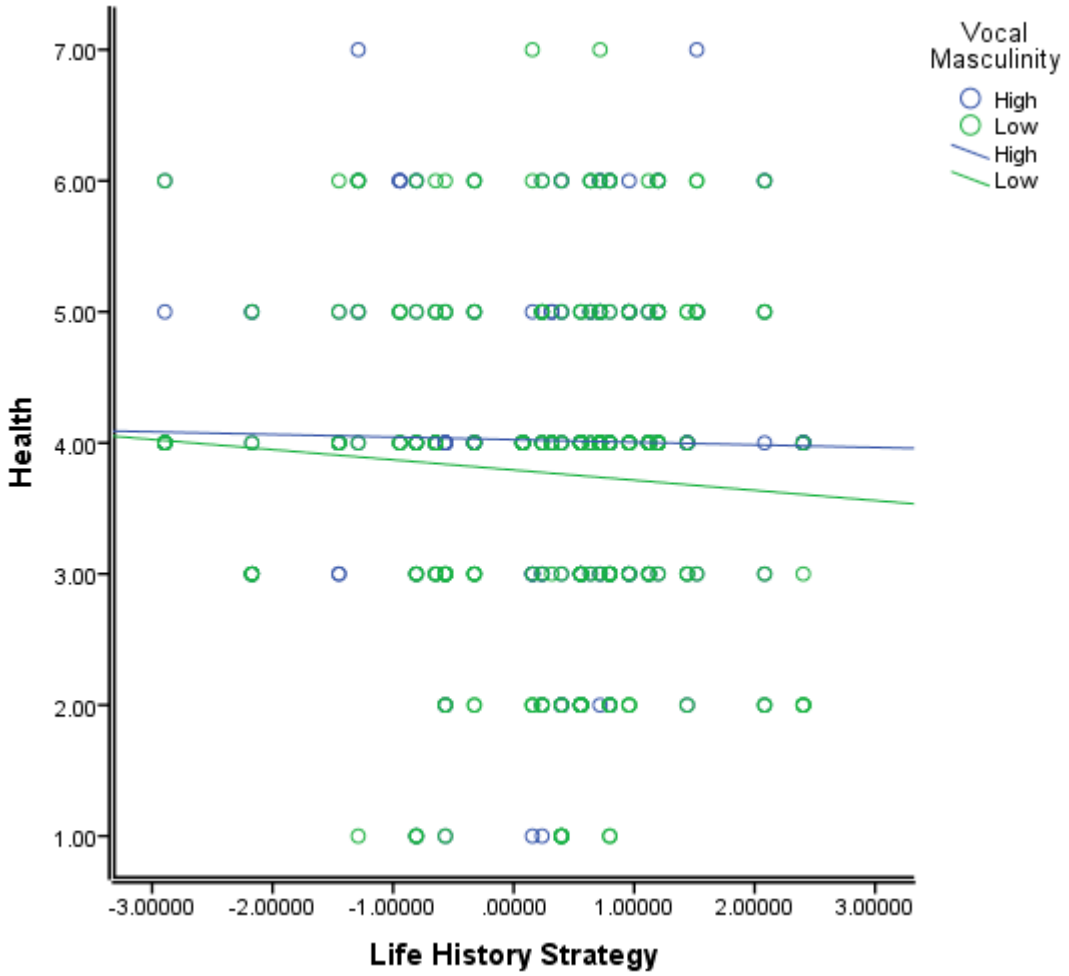

Figure 6. Life History Strategy and health judgments.

There was also an interaction between facial masculinity and pathogen disgust on judgments of health, $F(1,451) = 7.31$, $p = .007$. As seen in *Figure 7*, as pathogen disgust increases, the health of high masculinity faces stays consistently high, but low masculinity faces are judged as progressively less healthy. The findings on health provide evidence for both H3 and H4.

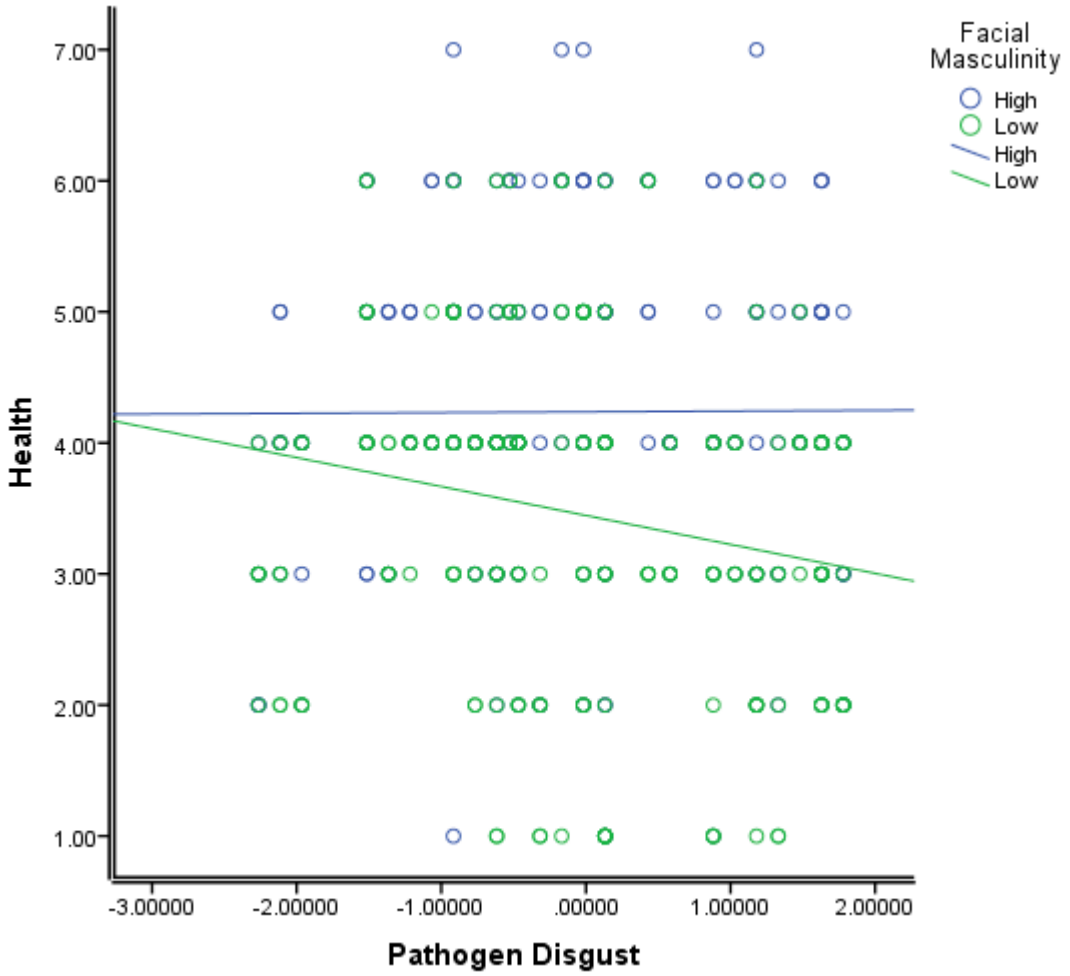

Figure 7. Pathogen disgust and health judgments.

On judgements of masculinity the HLM replicated the effects of facial and vocal masculinity, but also provided evidence an interaction between facial masculinity and SOI, $F(1,451) = 5.57$, $p = .019$. As can be seen in *Figure 8*, as SOI becomes increasingly unrestricted, men with high masculinity faces are judged increasingly more masculine than men with low masculinity faces.

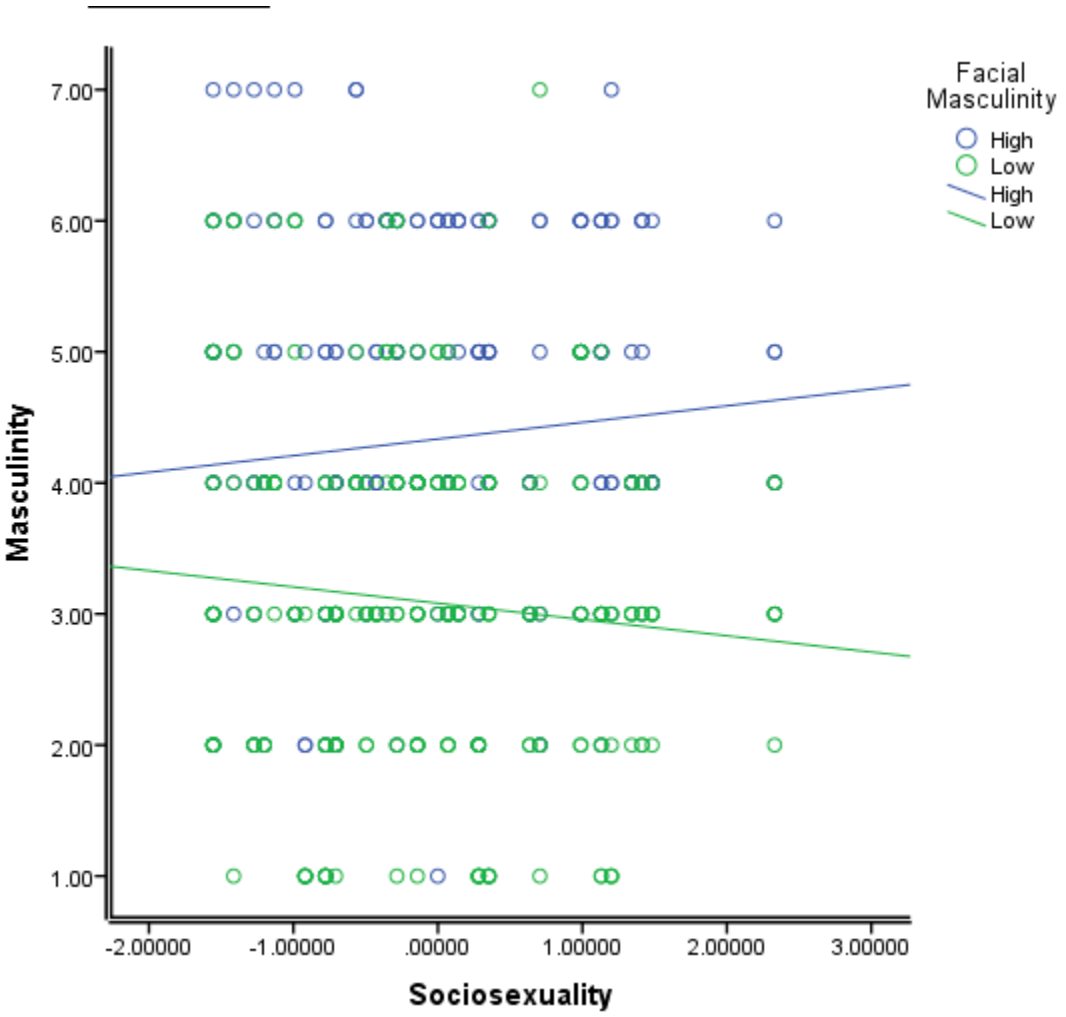

Figure 8. Socio-sexual orientation and judgments of masculinity.

There was also evidence for an interaction between vocal masculinity and SOI, $F(1,451) = 7.16$, $p = .008$. The effect of vocal masculinity and SOI (see *Figure 9*) shows that high masculinity voices are perceived as more masculine than low masculinity voices only among women with restricted SOIs.

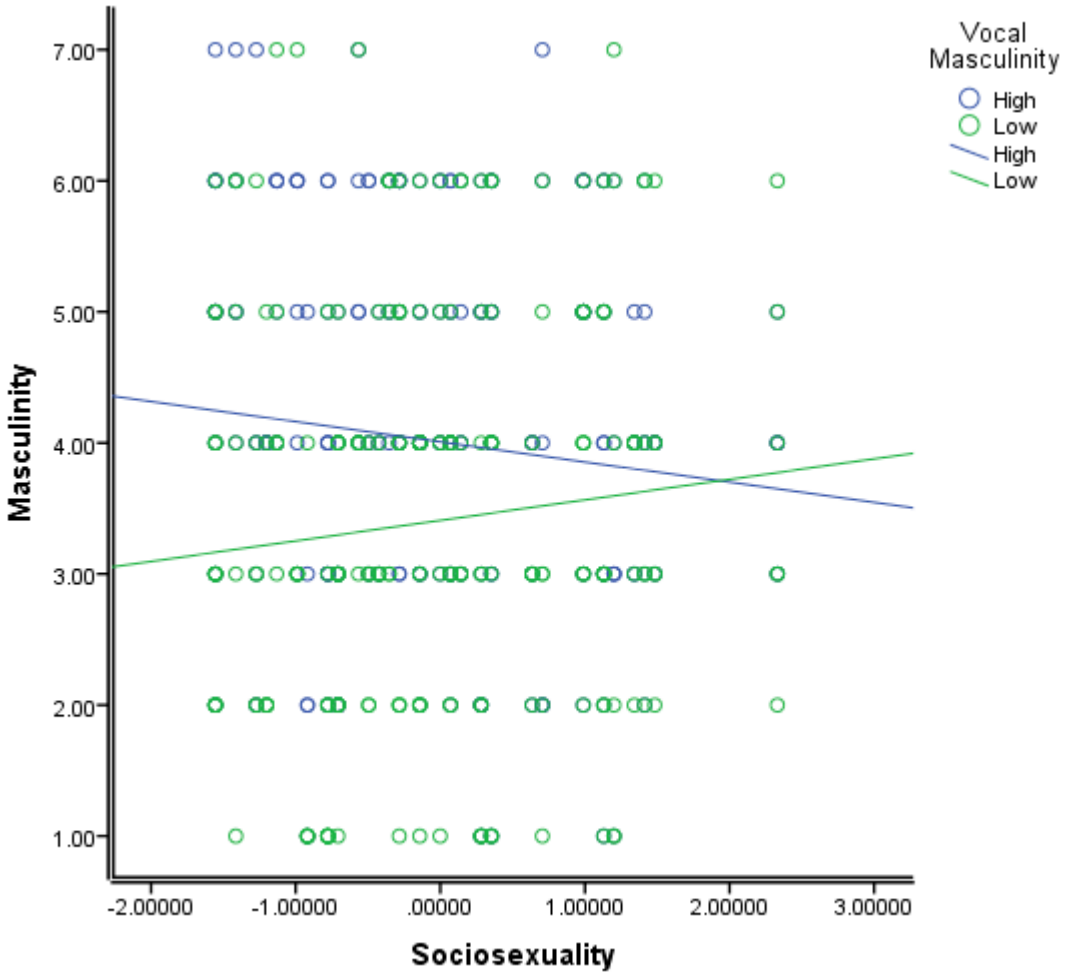

Figure 9. Interaction between socio-sexual orientation and vocal masculinity.

Finally, there was an interaction between facial masculinity and pathogen disgust, $F(1,451) = 6.47$, $p = .011$. As seen in Figure 10, as pathogen disgust increases, the perceived differences between low and high masculinity faces become amplified. These interactions provided further evidence for H3 and H4.

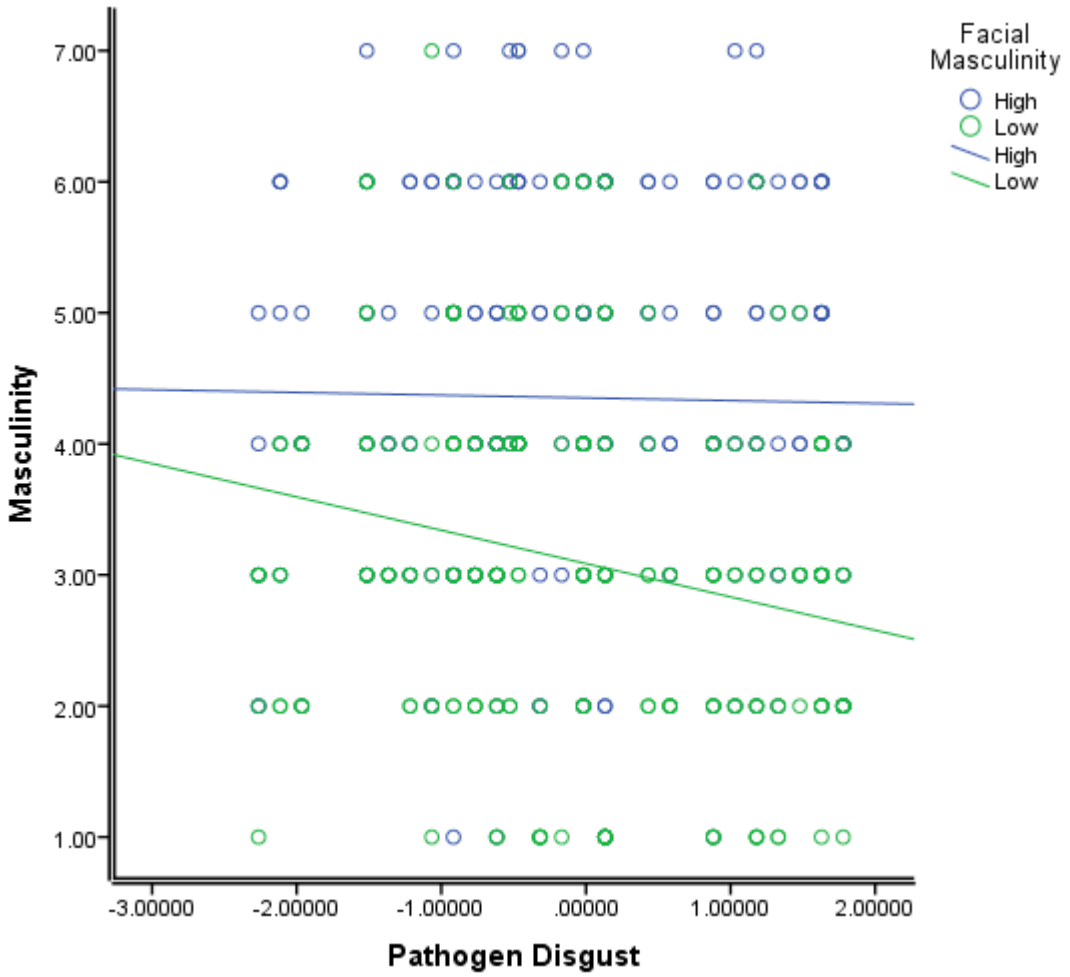

Figure 10. Pathogen disgust and facial masculinity.

Discussion

The RSH predicted that combinations of high or low facial and vocal masculinity would be judged more extremely on sexual attraction than other (e.g., high facial and low vocal masculinity) combinations. The MMH, however, predicted that facial and vocal masculinity would constitute independent and additive signals of T, and impose different effects on different dependent measures. Across measures, there were strong main effects of facial masculinity on all five dependent measures, but only small main effects for vocal masculinity. In each case—with one exception—facial masculinity and vocal masculinity did

not interact. The one exception, fighting ability, showed evidence for the RSH. Men who were low in both facial and vocal masculinity were judged relatively less able fighters than all other men. Taken together, there was little evidence in support of the RSH or the MMH. Nonetheless, the interaction on fighting ability can be interpreted as providing modest support for both hypotheses.

The findings also showed that facial masculinity has considerably stronger effects on short-term and long-term sexual attraction, judgments of health, and masculinity. The only exception was on judgments of fighting ability. In this case the main effect for vocal masculinity was a large effect, though it was still approximately four times smaller than the effect of facial masculinity. These findings show that facial masculinity has surprisingly large effects on judgments compared with vocal masculinity.

Evidence was found in support of the intrasexual competition hypothesis which states that if male intrasexual competition, and not female choice, was the selective pressure for high facial and vocal masculinity then women who have unrestricted socio-sexual orientations should rate males with the highest combinations of facial and vocal masculinity most favorably. While there was no evidence that the combination of facial and vocal masculinity mattered, there was evidence that as socio-sexual orientation became increasingly unrestricted, women's short-term preference for men with high over low masculinity faces increased. There was also evidence that the judgment of masculinity was moderated by SOI. Women with increasingly unrestricted SOIs judged men with high masculinity faces as increasingly more masculine than their low masculinity counterparts. Surprisingly, in the one case where judgments of vocal masculinity were moderated, women with increasingly unrestricted SOIs perceived less differences in the masculinity of high and low masculinity voices. This finding is difficult to reconcile with the hypothesis as the

opposite pattern would have been predicted.

The findings were not consistent with predictions derived from life history theory. As women's life history strategy become slower, women's short- and long-term preferences for men with low masculinity faces decreased, while there were consistently higher preferences for high masculinity faces. The same pattern was observed on judgments of health. While these findings were not strictly consistent with predictions they may be reconciled with LHT (see below).

Finally, there was also evidence for pathogen-mediated sexual selection. Perceived health increased for high masculinity faces when pathogen disgust was higher. Additionally, as pathogen disgust increases, we also saw decreases in judgments of the ability of low masculine men to win fights.

Implications for the RSH

Though little evidence was found in support of the RSH, suggesting that human sexual selection has taken a different route from other species (e.g., Partan, et al., 2004) there was some evidence in support of the RSH on fighting ability. Men who were low in both facial and vocal masculinity were judged as least likely to be successful in a fight with someone their own age. If facial and vocal masculinity have evolved, therefore, due to pressures from intrasexual competition it would be potentially interesting to replicate this multimodal study with male judges. It could be that the RSH is useful when weighing cost-benefit ratios of engaging in competition with a potential rival.

Implications for the MMH

Similarly, not much substantiation for the MMH was found in the data; findings were relatively consistent across the dependent measures. However, this study did not address the issue of time with regards to the MMH. As previously mentioned, many secondary sexual

characteristics (‘ornaments’) are developed prior to a mating season, and potentially reflect the quality of the animal leading up to the season. In humans, addressing the time aspect of the MMH could potentially be done by examining judgments of overall quality on targets from different life stages. This could also potentially be addressed by examining judgments of overall quality on female targets throughout the menstrual cycle.

There was substantial evidence provided for H3, the ‘intrasexual competition hypothesis’, and findings were consistent with previous research (Hill, Hunt, Welling, et al., 2013) that explored the pressures of intrasexual competition on sexual selection. Hill, et al., (2013) collected stimuli from fraternities on a university campus, whereby fraternity members contributed their own audiovisual samples as stimuli, and rated others in their fraternity on how likely they were to win in a physical fight with the target, and to estimate how many sexual partners the target has had. All audio and visual stimuli were also rated by female participants on short-term sexual attractiveness. Female choice favored height, and more attractive (but not more masculine) faces and voices. Women preferred men of “intermediate brawniness” (p. 339) and that the brawnier a man, the more important it is he has a feminine face and voice. Researchers concluded that beyond height, mating success is not determined by masculine features under female choice. Contrastingly, intrasexual contests exerted positive directional selection on girth and vocal masculinity suggesting that masculinity in males evolved as a byproduct of male competition, not of female choice. Interestingly, the traits favored by male contests, and not by female choice, predicted mating success, suggesting stronger sexual selection pressures through male contests than female choice. Given the current findings, and those of Hill et al., (2013) it would be interesting to replicate the present study with male participants judging male targets to ultimately substantiate further evidence for the intrasexual competition hypothesis.

Evidence for the Intrasexual Competition Hypothesis

There was evidence for the intrasexual competition hypothesis. Women with increasingly unrestricted socio-sexualities had a stronger preference for men with more masculine faces as short- and long-term mates, and judged the faces of masculine men as more masculine than women with more restricted socio-sexualities. These findings suggest that female choice is reflective of men's ability to prevail in intrasexual competition and thus serves as better quality mates than men with lower masculinity faces. These findings are broadly consistent with previous research, but this is the first study to disambiguate the roles of facial and vocal masculinity. While other researchers have found evidence that both male faces and voices are largely evolved through male intrasexual competition, these findings suggest that the primary signal is the face, not the voice. It is nonetheless possible that male intrasexual competition has produced masculinity in male faces and voices. One possibility is that female judgments of males is focused on faces, whereas males who assess other males may pay more attention to voices than do women. Indeed, research shows that the voice is used by males to generate assessments of intentions to aggress (Zhang & Reid, in press) in a dynamic fashion. While women should also attend to this information, it is likely that our acontextual and neutral stimuli (counting one to five) would have decreased the relevance of the voice for assessment.

Evidence for the Life History Hypothesis

LHT predicts that women who have faster life history strategies would have a stronger preference for more masculine men. However, the findings showed that preferences for masculine male faces were relatively consistent (and high) independent of women's life history strategy. Instead, as life history slowed, women were less attracted to low masculine men as short- and long-term partners, and perceived them as somewhat less healthy. This

finding may be reconciled with LHS in that women with slow strategies have a weaker preference for the low masculinity males because they would make for poorer parental investors in the long-term. Of course, we would require items to measure parental investment ability to test this hypothesis. Nonetheless, previous research by Roney, Hanson, Durante, and Maestripieri (2006) shows that women can deduce men's interest in infants from facial photographs, and the ability to do so is independent of facial masculinity judgments.

Implications for the Pathogen-Mediated Sexual Selection Hypothesis

There was also evidence for the parasite avoidance hypothesis. Women who are higher on pathogen disgust preferred high masculinity faces to low masculinity faces. These findings are consistent with extant research (e.g., Little et al., 2011; DeBruine et al., 2010; Jones et al., 2012). While previous research considered the role of pathogen avoidance mechanisms on judgments of faces and voices independently, this was the first study to include judgments of both faces and voices concurrently. While previous work found that both faces and voices are evaluated as sources of information for pathogen avoidance, the current findings suggest that faces are the primary source of information.

Most interestingly, and unique to the present study, the findings suggest that faces contain substantially more information than voices. This is consistent with previous research which found that women can track men's potential parental investment merely from photos. Roney, et al., (2006) examined female judgements of male faces on attractiveness, masculinity, interest in infants, and kindness; photos of male participants were collected from two groups – one group was exposed to a five-minute conversation with a female researcher, and the other sat quietly waiting, prior to having their photo taken. Participants were instructed to display a neutral expression. Participants also provided a saliva sample for tracking testosterone concentration. Findings indicated that women's judgments of men's

interest in infants were significantly correlated with men's interest in infants. A correlation was not found between men's testosterone concentration and scores interest in infants, suggesting that "there exist somewhat independent indices of men's genetic and paternal quality rather than a single dimension" (p. 2173). Therefore, further research on women's judgements of male faces and the information conveyed to female judges is warranted.

This is inconsistent with previous research examining male judgments of female faces and voices. For example, Collins and Missing (2003), had male judges separately rate three groups of female speakers. Audio and visual cues were rated separately on attractiveness, and ratings demonstrated that "women with attractive faces had attractive voices" (p. 997), providing possible evidence for the RSH. Given that both faces and voices contain T markers, the present research expected to find evidence for the RSH in male faces and voices, consistent with previous studies on females (Abend, Pflüger, Koppensteiner, Coquerelle, & Grammar, 2014; Feinberg et al., 2005). A possible explanation for these inconsistencies is that male choice, not intrasexual competition, exerted pressure on sexually selected traits in females. A similar study to Puts et al., (2007; 2011; 2012) however examining the selection pressures that influenced ornaments in females, as opposed to males, could shed light on these inconsistences.

Limitations

The present study was not without limitations.

Small sample; more stimuli; test hypothesis about correlations between traits (i.e., degree of correlation between facial and vocal masculinity); experimental inducation of facial and vocal masculinity would give more control over the stimuli; we did not get a measure of female cycling fertility, and previous research shows that this is important.

Future Research

Research on female preferences and mating strategies typically consider participants' stage in the menstrual cycle at time of data collection, and use of hormonal contraceptives as well. Cyclic shifts and hormonal contraceptives are well documented as influencing female preferences for masculine traits (Feinberg, et al., 2006; Feinberg, et al., 2008; Gangestad & Thornhill, 2003; Rhodes, 2006). For example, Feinberg, et al., (2006), had participants judge vocal cues of males that were manipulated for femininity and masculinity based on attractiveness. Preferences for masculinity in voices were found, though preferences were stronger during the fertile than the non-fertile phase.

Similarly, Johnston, Hagel, Franklin, Fink, and Grammer (2001) found females preferred a male face "on the masculine side of average" (p. 251) though this was highest when women were in their high-conception risk window. They utilized a within-subjects design in which female participants evaluated composite male faces that had been digitally feminized and masculinized using a slider to indicate the face they preferred; participants returned to the lab and performed the same task two weeks following the initial data collection. They also reported that masculine faces were rated as most desirable for short-term partners, (i.e., when women are concerned with finding good genes). These inconsistencies in findings indicate that female preferences reflect cyclic changes. Female preferences for masculine traits therefore are context dependent, i.e., when gene quality matters, such as during peak fertility, women want masculine men consistent with the RSH. Future research should possibly consider incorporating measuring fertility over time, to consider how cyclical changes affect women's preferences for masculinity in faces and voices.

Findings from the present study suggesting that faces contain more relevant information than voices for women who are higher on pathogen disgust should be explored

further. The present study examined faces and voices concurrently, whereas previous studies have examined facial and vocal cues separately. Further studies of a similar nature should explore simultaneously presented facial and vocal cues and the relationship with pathogen disgust.

Conclusion

This study has contributed to further knowledge on the complex processes involved with signaling quality to potential mates and rivals. We have established that, in humans, it is likely that intrasexual competition, and not female choice, exerted the greatest pressure on secondary sexual characteristics in males. Female preferences for masculinity in faces and voices are context specific; women with high pathogen disgust, pursuing a fast life history strategy, with a relatively unrestricted socio-sexuality prefer masculinity in male faces and voices. Cyclical hormonal changes also influence female preferences, and this is something that should be explored further in future studies of a similar vein.

Footnotes

[1] Signals are distinguished from cues and indexes. Cues are like signals in that they, too, convey information; however, cues are not a product of selection pressures. Laidre and Johnstone (2013) illustrate this with an example of a mouse foraging for food, and subsequently making a rustling noise; that rustling noise conveys information to a potential predator, but the rustling sound is a by-product of the foraging. The rustling noise itself has not evolved for the specific purpose of communicating information to others. This contrasts with the peacock's plumage, which is a sexually selected adaptation in which the traits that have evolved have done so because they increased the frequency of the genes associated with them in the population.

[2] Quality refers to heritable fitness. For example, a male that has genes for very good quality immune system can pass those genes to offspring, increasing the likelihood that those offspring will themselves survive and reproduce.

[3] A third hypothesis, the unreliable signal hypothesis, assumes that some traits are not reliable indicators of quality, and are merely maintained because they are not costly. Research has already demonstrated that male facial and vocal masculinity are used by women in mate selection, so we can rule this hypothesis out *a priori*.

[4] Work on female secondary sexual characteristics has produced somewhat mixed findings. Abend, Pflüger, Koppensteiner, Coquerelle, and Grammar (2014) hypothesized that female faces and voices contain redundant information, but that both visual and audio cues signal female attractiveness. However, the researchers presented participants with facial and vocal stimuli in separate blocks, which is not a true test of the RSH (which assumes that information is integrated simultaneously). Other work by Collins and Missing (2003) had male judges separately rate three groups of women. Audio and visual cues were rated

separately on attractiveness, and ratings demonstrated that "women with attractive faces had attractive voices" (p. 997), consistent with the RSH. Further, Feinberg et al., (2005) conducted three studies on facial and vocal femininity and attractiveness. They found that women with more feminine faces had higher pitched voices, and that facial stimuli (whether digitally altered or natural) with higher pitched voices were more attractive than those with lower pitched voices. The researchers concluded that female faces and voices contain redundant information. However, stimuli were again presented in separate blocks (i.e., participants did not receive multimodal cues simultaneously). Research on redundant signaling in females provides some evidence for the RSH.

[5] In humans, evidence shows that different sexually selected ornaments do indeed communicate qualitatively different information. For example, in women the waist-to-hip ratio is a signal of the possession of omega-3 fatty acids, which are crucial for nervous system and brain development (see Lassek & Gaulin, 2008), whereas feminine facial features reflect the ratio of estrogen to T. Women with relatively more estrogen than T have more feminine faces, which men find attractive, probably because estrogens are immune suppressant (see Little et al., 2011).

References

Abend, P., Pflüger, L.S., Koppensteiner, M., Coquerelle, M., & Grammer, K. (2014). The sound of female shape: A redundant signal of vocal and facial attractiveness. *Evolution and Human Behavior*, doi: 10.1016/j.evolhumbehav.2014.10.004.

Andersson, M. (1994). *Sexual selection*. (1st ed.). Princeton: Princeton University Press.

Collins, S.A. & Missing, C. (2003). Vocal and visual attractiveness are related in women. *Animal Behaviour, 65*, 997-1004.

Darwin, C. R. (1859). *On the origin of species by natural selection, or the preservation of favoured races in the struggle for life.* (1st ed.). London: John Murray.

Darwin, C. R. (1871). *The descent of man, and selection in relation to sex*. (1st ed.). London: John Murray.

DeBruine, L.M., Jones, B.C., Tybur, J.M., Lieberman, D., & Griskevicius, V. (2010). Women's preferences for masculinity in male faces are predicted by pathogen disgust, but not by moral or sexual disgust. *Evolution and Human Behavior, 31*, 69-74.

Feinberg, D. R., DeBruine, L. M., Jones, B.C., & Little, A. C. (2008). Correlated preferences for men's facial and vocal masculinity. *Evolution and Human Behavior, 29*, 233-241.

Feinberg, D. R., Jones, B.C., DeBruine, L. M., Moore, F. R., Law Smith, M. J., Cornwell, R.E., Tiddeman, B. P., Boothroyd, L. G., & Perrett, D. I. (2005). The voice and face of woman: One ornament that signals quality? *Evolution and Human Behavior, 26*, 398-408.

Feinberg, D.R., Jones, B.C., Law Smith, M. J., Moore, F. R., DeBruine, L.M., Cornwell, R.E., Hillier, S.G., & Perrett, D. I. (2006). Menstrual cycle, trait estrogen level, and

masculinity preferences in the human voice. *Hormones and Behavior, 49*, 215-222.

Figueredo, A.J., Wolf, P.S.A., Olderbak, S.G., Gladden, P.R., Ferreira Fernandes, H.B., Wenner, C., Hill, D., Andrzejczak, D.J., Sisco, M.M., Jacobs, W.J., Hohman, Z.J., Sefcek, J.A., Kruger, D., Howrigan, D.P., & MacDonald, K. (2014). The psychometric assessment of human life history strategy: A meta-analytic construct validation. *Evolutionary Behavioral Sciences, 8*(3), 148-185.

Gangestad, S. W., & Thornhill, R. (2003). Facial masculinity and fluctuating asymmetry. *Evolution and Human Behavior, 24*, 231-241.

Gildersleeve, K., Haselton, M. G., Fales, M. R. (2014). Do women's mate preferences change across the ovulatory cycle?: A meta-analytic review. *Psychological Bulletin, 1*(1), 1-56.

Grafen, A. (1990). Biological signals as handicaps. *Journal of Theoretical Biology, 144*(4), 517- 546.

Hill, A. K., Hunt, J., Welling, L., L. M., Cardenas, R. A., Rotella, M.A., Wheatley, J. R., Dawood, K., Shriver, M. D., & Puts, D. A. (2013). Quantifying the strength and form of sexual selection on men's traits. *Evolution and Human Behavior, 34*, 334-341.

Jasieńska, G., Ziomkiewicz, A., Ellison, P.T., Lipson, S.F., & Thune, I. (2004). Large breasts and narrow waists indicate high reproductive potential in women. *Proceedings of the Royal Society B: Biological Sciences, 271*(1545), 1213-1217.

Johnston, V. S., Hagel, R., Franklin, M. Fink, B., & Grammer, K. (2001). Male facial attractiveness evidence for hormone-mediated adaptive design. *Evolution and Human Behavior, 22*, 251-267.

Jones, B.C., Feinberg, D.R., Watkins, C.D., Fincher, C. L., Little, A.C., & DeBruine, L. M. (2012). Pathogen disgust predicts women's preferences for masculinity in men's

voices, faces, and bodies. *Behavioral Ecology,* doi:10.1093/beheco/ars173

Kaplan, H.S., & Gangestad, S.W. (2005). Life history theory and evolutionary psychology. In Buss, D.M. (Eds.), *The handbook of evolutionary psychology* (68-95). Hoboken: John Wiley & Sons, Inc.

Kruger, D.J., & Fisher, M.L. (2008). Women's life history attributes are associated with preferences in mating relationships. *Evolutionary Psychology, 6*(2), 289-302.

Laidre, M.E., & Johnstone, R.A. (2013). Animal signals. *Current Biology, 23*(18), R829-R833.

Lassek, W.D., & Gaulin, S.J.C. (2008). Waist-hip ratio and cognitive ability: Is gluteofemoral fat a privileged store of neurodevelopmental resources? *Evolution and Human Behaviour, 29*, 26-34.

Little, A.C., DeBruine, L.M., & Jones, B.C. (2011). Exposure to visual cues of pathogen contagion changes preferences for masculinity and symmetry in opposite-sex faces. *Proceedings of the Royal Society: B, 278,* 2032-2039.

Loyau, A., Gomez, D., Moureau, B., Théry, M., Hart, N.S., Saint Jalme, M., Bennett, A. T. D., &

Sorci, G. (2007). Iridescent structurally based coloration of eyespots correlates with mating success in the peacock. *Behavioral Ecology, 18*(6), 1123-1131.

Maynard Smith, J., & Harper, D. (2003). *Animal signals*. Oxford: Oxford University Press.

Miller, G. F. (2001). *The mating mind: How sexual choice shaped the evolution of human nature*. New York: Anchor Books.

Møller, A. P., & Pomiankowski, A. (1993). Why have birds got multiple sexual ornaments? *Behavioral Ecology and Sociobiology, 32*(3), 167-176.

Partan, S., Yelda, S., Price, V., & Shimizu, T. (2005). Female pigeons, Columba livia, respond to multisensory audio/video playbacks of male courtship behaviour. *Animal Behaviour, 70*, 957-966.

Penke, L., & Asendorpf, J. B. (2008). Beyond global sociosexual orientations: A more differentiated look at sociosexuality and its effects on courtship and romantic relationships. *Journal of Personality and Social Psychology, 95*, 1113-1135.

Puts, D.A., Apicella, C.L., & Cárdenas, R.A. (2011). Masculine voices signal men's threat potential in forager and industrial societies. *Proceedings of the Royal Society B,* doi: 10.1098/rspb.2011.0829

Puts, D.A., Hodges, C.R., Cárdenas, R.A., & Gaulin, S.J.C. (2007). Men's voices as dominance signals: Vocal fundamental and formant frequencies influence dominance attributions among men. *Evolution and Human Behavior, 28*(5), 340-344.

Puts, D.A., Jones, B.C., & DeBruine, L.M. (2012). Sexual selection on human faces and voices. *The Journal of Sex Research, 49*(2-3), 227-243.

Rhodes, G. (2006). The evolutionary psychology of facial beauty. *Annual Review of Psychology, 57*, 199-226.

Rhodes, G., Chan, J., Zebrowitz, L. A., & Simmons, L. W. (2003). Does sexual dimorphismin human faces signal health? *Proceedings of the Royal Society B, 270*, S93-S95.

Roney, J.R., Hanson, K.N., Durante, K.M., & Maestripieri, D. (2006). Reading men's faces: Women's mate attractiveness judgments track men's testosterone and interest in infants. *Proceedings of the Royal Society B, 273*, 2169-2175.

Searcy, W.A., & Nowicki, S. (2005). *The evolution of animal communication*. Princeton: Princeton University Press.

Smith, J. M., & Harper, D. (2003). *Animal signals*. Oxford University Press.

Tajfel, H., & Billic, M. (1974). Familiarity and categorization in intergroup behavior. *Journal of Experimental Social Pscyhology, 10*(2), 159-170.

Tybur, J.M., Lieberman, D., & Griskevicius, V. (2009). Microbes, mating, and morality: Individual differences in three functional domains of disgust. *Journal of Personality and Social Psychology, 97*(1), 103-122.

Wedekind, C., & Füri, S. (1997). Body odour preferences in men and women: Do they aim for specific MHC combinations or simply heterozygosity? *Proceedings of the Royal Society B, 264*(1387), doi: 10.1098/rspb.1997.0204

Zahavi, A., & Zahavi, A. (1997). *The Handicap Principle: A Missing Piece of Darwin's Puzzle*. New York: Oxford University Press.

Zhang, J., & Reid, S. A. (in press). Aggression in young men high in threat potential increases after hearing low-pitched male voices: Two tests of the retaliation-cost model. *Evolution and Human Behavior*.

Appendix A




Appendix B

	Not at all 1	2	3	Average 4	5	6	Extremely 7
How attractive is this person for a long-term committed relationship?	○	○	○	○	○	○	○
How attractive is this person for a short-term fling?	○	○	○	○	○	○	○
How likely is it that this man would win a fight with an average man his age?	○	○	○	○	○	○	○
How healthy is this man?	○	○	○	○	○	○	○
How masculine do you think this man is?	○	○	○	○	○	○	○

Demographics

In this final section, we are going to ask you some questions about yourself. Keep in mind that all answers are anonymous and confidential.

What is your age? _____

Your ethnicity is? (may choose more than one):

White □

Black or African American □

American Indian or Alaskan Native □

Asian □

Native Hawaiian or Pacific Islander □

Hispanic/Latino □

Other □ _____

Your biological sex is:

Male □

Female □

You are most attracted to:

Men □

Women □

Both men and women □

Are you currently in a relationship?

Yes □

No □

SOI-R

We are going to ask you some questions that are sensitive in nature. Your responses are important for our research, however if you feel uncomfortable you can choose not to answer. However, your personal identity will not be tied to your response in any way, so we hope that you answer honestly.

With how many different partners have you had sex within the past 12 months?

0 □ 1 □ 2 □ 3 □ 4 □ 5-6 □ 7-9 □ 10-19 □ 20+ □

With how many sexual partners have you had sexual intercourse on *one* and *only one* occasion?

0 □ 1 □ 2 □ 3 □ 4 □ 5-6 □ 7-9 □ 10-19 □ 20+ □

With how many different partners have you had sexual intercourse without having an interest in a long-term committed relationship with this person?

0 □ 1 □ 2 □ 3 □ 4 □ 5-6 □ 7-9 □ 10-19 □ 20+ □

Sex without love is OK.

Strongly disagree								Strongly agree
1	2	3	4	5	6	7	8	9
□	□	□	□	□	□	□	□	□

I can imagine myself being comfortable and enjoying "casual" sex with different partners.

Strongly Strongly

disagree									agree
1	2	3	4	5	6	7	8	9	
☐	☐	☐	☐	☐	☐	☐	☐	☐	

I do *not* want to have sex with a person until I am sure that we will have a long-term, serious relationship

Strongly disagree									Strongly agree
1	2	3	4	5	6	7	8	9	
☐	☐	☐	☐	☐	☐	☐	☐	☐	

Please rate the following items on how often they occur.

	Frequency								
	Never	Very seldom	About once every 2-3 months	About once a month	About once every 2 weeks	About once a week	Several times per week	Nearly every day	At least once a day
How often do you fantasize about having sex with someone you are *not* in a committed relationship with?	○	○	○	○	○	○	○	○	○
How often do you experience sexual arousal when you are in contact with someone you are *not* in a committed romantic relationship with?	○	○	○	○	○	○	○	○	○
In every day life, how often do you have spontaneous fantasies about having sex with someone you have just met?	○	○	○	○	○	○	○	○	○

Disgust Sensitivity

The following items describe a variety of concepts. Please rate how disgusting *you find the concepts described in the items, where* 0 *means that you do not find the concept disgusting at all and* 6 *means that you find the concept extremely disgusting.*

	Not at all disgusting 0	1	2	3	4	5	6
Shoplifting a candy bar from a convenience store							
Seeing some mold on old leftovers in your refrigerator.							
Standing close to a person who has body odor.							
Watching a pornographic video.							
Stealing from a neighbor.							
Performing oral sex.							
Finding out someone you do not like has sexual fantasies about you.							

Intentionally lying during a business transaction.							
Deceiving a friend.							
Forging someone's signature on a legal document.							
Stepping on dog poop.							
Shaking hands with a stranger who has sweaty palms.							
Accidentally touching a person's bloody cut.							
Sitting next to someone who has red sores on their arm.							
Having anal sex with someone of the opposite sex.							
Hearing two strangers having sex.							
A student							

cheating to get good grades.							
A stranger of the opposite sex intentionally rubbing your thigh in an elevator.							
Bringing someone you just met back to your room to have sex.							
Cutting to the front of a line to purchase the last few tickets to a show.							
Seeing a cockroach run across the floor.							

Life History Strategy

Please indicate how strongly you agree or disagree with the following statements. Use the scale below and for any item that does not apply to you, please select "0".

	Disagree strongly -3	Disagree somewhat -2	Disagree slightly -1	Don't know/not applicable 0	Agree slightly 1	Agree somewhat 2	Agree strongly 3

I can often tell how things will turn out							
I try to understand how I got into a situation to figure out how to handle it							
I often find the bright side to a bad situation.							
I don't give up until I solve my problems.							
I often make plans in advance.							
I avoid taking risks.							
While growing up, I had a close and warm relationship with my biological mother.							
While growing up, I had a close and warm							

relationship with my biological father.							
I have a close and warm relationship with my own children.							
I have a close and warm relationship with my sexual partner.							
I would rather have one than several sexual relationships at a time.							
I have to be closely attached to someone before I am comfortable having sex with them.							
I am often in social contact with my blood relatives.							
I often get emotional support							

and practical help from my blood relatives.							
I often give emotional support and practical help from my blood relatives.							
I am often in social contact with my friends.							
I often get emotional support and practical help from my friends.							
I often give emotional support and practical help from my friends.							
I am closely connected to and involved in my community.							
I am closely connected to and involved in my religion.							

Manipulation Check

Do you *personally* know any of the men in the study?

Yes □

No □

While completing the tasks did you find you were distracted?

Yes □

No □