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Abstract

We manipulated facial masculinity (masculine-morph/feminine-morph) and color (red/white) through two independent studies—one in-lab at the University of Dayton and one online using Amazon's MTurk—to examine its effect on social status and attractiveness for men when rated by women. We specifically aimed to see if the color red could serve a compensatory effect for feminine-faced men, who were least likely to be found attractive by women at peak fertility. When paired with red, women rated the masculine and feminine faces higher in social status. Through this increase in social status, the color red was also able to indirectly increase the physical attractiveness of the men. Additionally, the sensitivity to the color red was predicted by conception risk, such that women closer to peak fertility were most attentive of the color red.

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Introduction

Over time, both men and women have inherited evolutionary drives that motivate them to select, obtain, and keep romantic and sexual partners in ways that most efficiently secure gene transmission to offspring (Sefcek, Brumbach, Vasquez, & Miller, 2007). For men, these evolutionary drives aim to secure a healthy offspring simply by seeking to reproduce with the greatest possible number of healthy women (Buss, 1994). For women, who face a higher cost of reproduction due to higher parental investment, the drive to find a healthy partner is balanced by the drive to find a partner that will remain loyal and be a strong resource-provider for the mother and child (Buss, 1994; Gangestad & Thornhill, 1998). In other words, while women are similar to men in that they seek partners that display genetic strength and health (Roberts & Little, 2008), they also seek men who are willing to make a higher parental investment during the vulnerable periods of pregnancy and nursing (Feingold, 1992).

The paradox that women face is that these two characteristics of men tend to be inversely related (Gangestad & Simpson, 2000; Boothroyd, Jones, Burt, & Perrett, 2007). Namely, the men with greater displays of genetic fitness also tend to be the ones least likely to remain with a partner and provide resources, while those who offer high parental investment typically do so because their genetic weakness limit the possibilities of finding other mates.

In an effort to address this paradox, female evolutionary motives push women to adopt the dual mating strategy (Gangestad & Simpson, 2000). The dual mating strategy suggests that women consistently seek and secure long-term partners who will provide resources at the cost of being less genetically healthy, but during ovulation they will seek

sexual activity outside of their relationship with another partner that is more genetically fit (Strassman, 1981; Pillsworth & Haselton, 2006). Ovulation is the very brief window of time in a woman's menstrual cycle, 24-48 hours, when she is able to reproduce. Given that brief window and the investment women have in offspring, women are motivated to secure the best genes possible while not compromising long-term support. While this model adds complexities and nuances to securing offspring that men do not face, it is worth noting that this model is arguably most harmful for genetically weak men. For these men, their own cues of genetic weakness limit their reproduction capabilities in that they are least likely to be found attractive by their partner at times when their partner has the highest chance of becoming pregnant (Gangestad, Thornhill, & Garver-Apgar, 2010). In order to increase their chances of reproduction, and to secure that an offspring they help raise is genetically theirs, these men must find ways to compensate for their genetic weakness.

The current study examines the efficacy of the color red as a possible compensatory tool for men with cues of genetic weakness. Specifically, we aimed to explore if pairing men with the color red would increase their perceived mate value to women as much as to match genetically fit men not paired with red. Several pieces of evidence in recent literature suggest that the color red increases mate value for both men and women. Men, for example, tend to rate pictures of women as more physically attractive when the picture is surrounded by a red border (Elliot & Niesta, 2008), and rate photographs of women in red shirts versus white shirts as being more sexually receptive (Pazda, Prokop, & Elliot, 2014). With regards to men, Elliot et al. (2010) found that a photo of a man is rated as more sexually attractive and higher in status when surrounded

by a red border versus when surrounded by a white border. In a follow-up to the study by Elliot and colleagues, Prokop, Pazda, and Elliot (2015) found that women were most sensitive to the red effect when nearing peak fertility. This seems to suggest that the same mechanisms that drive women to seek genetically fit men during times of ovulation also make women more attentive to the color red, therefore implying that the color red could be a useful compensatory tool.

For the purpose of this study, genetic fitness was operationalized as facial masculinity. Previous studies have established a strong positive correlation between a masculine face and the perceived genetic strength of men. For example, men with highly masculine faces are perceived to have had more sexual partners in the past and be better suited for a short-term relationship when compared to males with more feminine faces (Thompson & O'Sullivan, 2013). More importantly, women tend to prefer men with high facial masculinity more during peak fertility than at any other point during their menstrual cycle (Little, Jones, & DeBruine, 2008), while preferring more feminine-faced men at times of low fertility (Jones, et al., 2008). In accordance with the dual mating strategy, women are more likely to be attracted to and seek out men outside of their relationship if their partner is low in facial masculinity, while a similar effect cannot be found for other partner traits such as intelligence (Gangestad, Thornhill, & Garver-Apgar, 2010). These findings suggest that facial masculinity is a key factor in perception of genetic fitness and can alone create an effect on a man's mate value.

We hypothesize that (1) the color red will serve a compensatory effect for genetically weak men (as determined by facial masculinity) in that it will elevate the mate value of these men, specifically their attractiveness and social status, to levels similar to

that of genetically fit men not paired with the color red and (2) this effect will be positively associated with conception risk such that women nearing peak fertility will display higher sensitivity to the red effect.

General Method

Two experiments were conducted to test whether the color red can improve mate-value for genetically weaker men. Using the same design for both studies, we conducted a 2 (facial masculinity: masculine, feminine) x 2 (color: red, white) between subjects design. Facial masculinity was manipulated using Fantamorph, a software program used to morph images. For both studies, a college-aged male face was combined with either a male face composite or a female face composite, such that the faces were still recognizable as the same man but with more pronounced masculine or feminine features. In addition, faces were bordered by either a red or white background, thus resulting in four possible images for the participant to view: masculine white, masculine red, feminine white, and feminine red.

Participants were asked to view the image for five seconds on a computer screen, following which they were asked questions about their perception of the man's attractiveness (*"How sexually attractive do you find this person?"*; Elliot & Niesta, 2008) and social status (*"How likely is it that this person tends to take charge in group settings?"*; Bryan, Webster, & Mahaffey, 2011). All answers were given on a 9-point Likert scale, where 1 was the lowest rating (least attractive, lowest social status) and 9 was the highest rating (most attractive, highest in status). Participants were then asked basic demographic questions, as well as to report information about their menstrual cycle in order to calculate conception risk (Wilcox et al., 2001).

Study 1

Study 1 was run in-lab at the University of Dayton. In total, 84 undergraduate, heterosexual women ($age_{\text{mean}} = 19.10$) participated for partial credit in an introductory psychology course. Participants were told the study was looking at first impressions, and completed the study on the computer. While the study included questions regarding the participants menstrual cycle, data for conception risk was not able to be calculated due to the small sample, in general, and a high percentage (48.81%) of participants who were currently taking a hormonal birth control, which interrupts natural ovulation. The face used for the first study was of a college-aged Caucasian man who was 45% morphed with a facial composite (in other words, the image presented was 55% the original face and 45% the average male or female face).

Study 2

The second study was conducted online using Amazon's MTurk participant pool. Ninety-one heterosexual women ($age_{\text{mean}} = 28.23$) participated for a small monetary reward typical of MTurk studies. Women were screened beforehand to exclude those on hormonal birth control. In addition to information about their menstrual cycle, all women were asked about their current relationship status. The photograph used in this study was the same as study 1, but the faced was morphed 40% with a composite (in other words, the image presented was 60% the original face and 40% the average male or female face).

Results

Study 1

To test whether attractiveness ratings varied as a function of color, face, or the interactive effects of face and color, an ANOVA was conducted where attractiveness was

predicted from color, face, and the color by face interaction. There was a significant main effect of facial type such that masculine faces ($M=5.33$, $SD=1.50$) were rated as more attractive than feminine faces ($M=4.01$, $SD=1.66$), $F(1,80)=16.74$, $p=.0001$. With regards to color, a slight increase was found in attractiveness ratings for faces paired with the color red ($M=5.18$, $SD=1.76$) when compared with faces paired with white ($M=4.40$, $SD=1.59$), but this effect did not reach statistical significance, $F(1,80)=3.42$, $p=.068$. These findings are qualified by a significant color by face interaction, $F(1,80)=4.01$, $p=.0487$. The interaction was decomposed by examining the simple effects of color in levels of face. The findings indicated that the color red significantly increased attractiveness ratings for masculine face men, $F(1,80)=16.06$, $p=.0001$ but not for feminine faced men, $F(1,80)=2.59$, $p=.1117$.

A second ANOVA was conducted to test the effects of color, face, and the color by face interaction on social status. A significant main effect was found for color such that faces paired with the color red ($M=5.97$, $SD=1.46$) were rated as significantly higher in social status than faces paired with white ($M=5.04$, $SD=1.38$), $F(1,80)=7.88$, $p=.0063$. There was no significant main effect for facial type, $F(1,80)=2.44$, $p=.122$, as well as no significant interaction of color and face, $F(1,80)=1.70$, $p=.1958$.

In order to test whether color indirectly improves attractiveness ratings through an increase in social status, a mediation analysis was conducted by using the PROCESS macro (Hayes, 2013). Controlling for facial masculinity, the indirect effect of color on attractiveness through social status was consistent with mediation, 95% percentile CI [-0.8621, -0.1393]. These findings suggest that the color red is positively associated with social status, which in turn leads to an increase in attractiveness ratings.

Study 2

To calculate conception risk, participants were asked to report the start date of their previous menstruation as well as the average length of their menstrual cycle. From there, they were placed on a standard 28-day cycle from which conception risk was calculated (range=.000-.094) for the day they participated using the reverse-cycle-day method (Garver-Apgar, Gangestad, & Thornhill, 2008) as well as actuarial data that provides a conception risk estimate for each participant (i.e., the likelihood of conceiving a child per sexual encounter that day; Wilcox et al., 2001).

An ANOVA was conducted to test whether the effects of color, face, conception risk, and all of the interaction terms on attractiveness ratings. A significant main effect of face was found such that masculine faces ($M=4.58$, $SE=0.28$) were rated as more attractive than feminine faces ($M=2.98$, $SE=.029$), $F(1,96)=16.07$, $p=.0001$. The effects of color, conception risk, and all higher order interactions were not significantly associated with attraction (all p values were greater than .43).

A second ANOVA was conducted to test the effects of color, face, conception risk, and all of the interaction terms on social status. There was a significant main effect of face such that masculine faces ($M=5.27$, $SD=0.25$) were rated as higher in social status than feminine faces ($M=4.07$, $SD=0.26$), $F(1,96)=11.03$, $p=.0013$. In addition, there was a significant interaction of color and conception risk, $F(1,96)=4.98$, $p=0.03$. The simple effects of conception risk were tested in levels of color and when viewing the faces paired with red, conception risk was positively associated with higher social status ratings, $b=12.33$, $F(1,96)=5.94$, $p=.0166$, but no such effect was found for participants

viewing the face paired with white $b=-11.69$, $F(1,96)=0.29$, $p=.5907$. All other variables and interactions were insignificant (all p values were greater than .12).

Next, a moderated mediation analysis was conducted using the PROCESS macro (Hayes, 2013) to test whether the association between conception and color was associated with attractiveness ratings due to an increase in perceived social status. Conception risk was positively associated with attractiveness ratings through increased perception of social status for the women viewing photos of men paired with the color red, and the findings are consistent with mediation, 95% percentile CI [3.383, 30.354]. For women who viewed the photo of a man paired with the color white, there was no evidence that social status mediated the association between conception risk and attractiveness ratings, 95% percentile CI [-14.458, 6.055]. These findings suggest that conception risk is indirectly associated with attractiveness ratings through social status only when women are viewing a photo of a man paired with the color red.

Discussion

We examined the potential compensatory effect that the color red may have on a man's perceived genetic weakness when evaluated by women. Previous literature has suggested that women are highly attentive to man's cue of genetic fitness (Roberts & Little, 2008), and most likely to be attracted to genetically fit men when they are most fertile (Gangestad & Simpson, 2000). We paired both genetically fit and genetically weak men (manipulated by facial masculinity) with the color red, which previous literature has demonstrated influences a woman's perception of the man's attractiveness and social status (Elliot, et al., 2010) and to which women appear most sensitive at times of high fertility (Prokop, Pazda, and Elliot 2015). The two studies described asked women to rate

the men's faces on attractiveness and social status in order to test if feminine-faced men (who are perceived as genetically weaker) would benefit from being paired with the color red versus the color white.

Study 1 suggests that while the amount to which a man is found more attractive when paired with the color red depends on facial masculinity, this trend seems to favor masculine-faced men who were already rated more attractive in the absence of the color red. In other words, the color red did not significantly increase the attractiveness of the feminine-faced men, but did improve the ratings for the masculine-faced men alone, thus widening the gap that had already favored masculine-faced men. In terms of mere attractiveness, it does not appear that the color red provides any direct benefit to the feminine-faced men; instead, it further enhances the deficit these men already have in attractiveness when compared to their masculine-faced counterparts.

With regards to social status, however, study 1 does hold some implications for a compensatory effect. Regardless of face type, faces paired with the color red saw an increase in social status ratings from the female participants. In addition, this increase in social status mediates the effects of the color red on attractiveness—namely, the reason that women find men more attractive when they are paired with the color red is due less to a change in their perception of appearance, and more on a perception that these men are more highly respected and dominant in social situations, which women find more attractive (Guéguen & Lamy, 2012; Bryan, Webster, & Mahaffey, 2011).

Study 2 focused again on this influence of the color red on attraction and social status, this time also taking into consideration participants' conception risk at the time of the study. Conception risk and color interacted such that, regardless of facial masculinity,

of the women who viewed a face paired with the color red, fertility was positively associated with attractiveness ratings because they viewed these men as higher in social status. Like in study 1, social status was an important factor in predicting attractiveness as it mediated the association between the interactive effects of color and conception risk on attractiveness.

The two studies described suggest that, with regards to female attraction to genetically weak men, the color red may serve an indirect compensatory effect by influencing perceptions of social status. This effect was found in two studies, using two different participant pools, and persisted both in lab and online. More importantly, study 2 found this effect to be strongest for women at times of high fertility—the time when genetically weak men are most likely to be viewed as least attractive. Because these findings didn't vary by facial masculinity, these findings suggest that pairing a genetically weaker man with the color red could improve his attractiveness to her (through social status) when she is fertile.

A potential weakness of our study was the manipulation of masculine and feminine faces using digital software. While various previous studies in the area of facial masculinity have used similar methods to manipulate masculinity, it is important to note that digitally morphing human faces introduces the risk of the faces appearing too “animated” and therefore less likely to mirror responses to unaltered human faces. Furthermore, digitally morphing masculinity on a face depends on a delicate balance of creating notable, distinct differences in the face while also not over-exaggerating the face to unrealistic proportions. While the face used in study 2 was adjusted to have more

subtle, believable distinctions, it is important to note further testing would still be required to find the optimal level at which masculinity can be manipulated.

The implications from these studies begin to build our knowledge of the ways in which men may compensate for perceived genetic weakness in the eyes of their potential mates, but further examination is needed for a fuller understanding of the role that the color red may play in this process. Our study, for example, introduced the color red by framing the images of the men in a red or white border; more realistic and subtle presentations of the color red—such as a man wearing a red shirt or tie—may elicit varied responses. In exploring the compensatory effect of the color red, it would be important to note the threshold at which the color is too subtle to have an effect.

As with many studies in the area, more precise and realistic measures of conception risk are also needed in order to find a consistent, robust effect. Future studies may consider using more advanced methods of measuring ovulation—such as hormone testing— in addition to the actuarial method, or evaluating conception risk as a within-subjects variable, in which the participants are tested at both high and low fertility and therefore serve as their own control.

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