Red Is Romantic, but Only for Feminine Females: Sexual Dimorphism Moderates Red Effect on Sexual Attraction

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Abstract: Previous researchers have documented that the color red enhances one's sexual attraction to the opposite sex. The current study further examined the moderating role of sexual dimorphism in red effects. The results indicated that red enhanced men's sexual attraction to women with more feminine facial characteristics but had no effect on ratings of perceived general attractiveness. Red clothing also had a marginally significant effect on men's sexual attractiveness. In addition, regardless of sexual dimorphism cues, male participants rated women with red as warmer and more competent. The underlying mechanisms of the red effect, the limitations of the current study, and suggestions for future directions are discussed.

Keywords: red effect, masculine, feminine, sexual attraction, perceived attractiveness

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Introduction

Color is an omnipresent and inseparable property of objects that constitute our perceptual world. Academic research has abounded on the physics, physiology, and aesthetics of color, but not until recently did psychologists formulate theories on its psychological meaning and effects (Elliot and Maier, 2014). Color-in-context theory, advanced by Elliot and colleagues, argues that color carries psychologically relevant meanings that are rooted either in biological or social learning processes (though they are not necessarily mutually exclusive). Viewing a color in a specific context may

automatically evoke several psychological processes, ranging from affect and cognition to behavior intentions (Elliot and Maier, 2012).

Recent studies have documented a unique effect of red on interpersonal attraction (Elliot and Niesta, 2008). Most researchers have concentrated on how and to what extent red enhances men's attraction to women. For example, several studies from America and Europe have consistently shown that women paired with a red background or clad in red are perceived as more sexually attractive by men (Elliot and Niesta, 2008; Guéguen, 2012a; Pazda, Elliot, and Greitemeyer, 2012, 2014; Re, Whitehead, Xiao, and Perrett, 2011; Roberts, Owen, and Havlicek, 2010; Schwarz and Singer, 2013; Stephen and McKeegan, 2010). However, perceived general attractiveness and other traits were affected less or not at all (Elliot et al., 2010; Elliot, Tracy, Pazda, and Beall, 2013; Schwarz and Singer, 2013). Moreover, research has demonstrated that the effect of red could also be extended to behaviors. For example, when dating a girl dressed in red, men tend to ask questions that are more intimate and show more sexual interest during conversation (Niesta-Kayser, Elliot, and Feltman, 2010). They also offer more help (Guéguen, 2012a) and are more likely to send a contact solicitation in an online dating context (Guéguen and Jacob, 2013). Men in bars send more solicitations to women wearing red lipsticks (Guéguen, 2012b), and male customers to a restaurant tend to tip waitresses wearing red lipstick or red clothes more generously (Guéguen and Jacob, 2012, 2014). On the other hand, a few studies also investigated the red effect on male attractiveness as perceived by women. Through a series of experiments, Elliot et al. (2010) indicated that women find men paired with a red background or dressed in red more sexually attractive and desirable, and further established that the perception of status mediated the red effect on male attractiveness.

Both social conditioning and evolutionary biology can explain the red effect on sexual attraction. In terms of social conditioning, the red effect may be construed as resulting from the repeated pairing of red and some particular concepts, information, and experiences. Over time, these pairings will form strong implicit associations such that the perception of red alone can activate culturally-conditioned psychological reactions (Elliot and Maier, 2012, 2014). Because red has been associated with romance, passion, lust, and fertility across nearly every long-standing civilization (Hutchings, 2004; Kaya and Epps, 2004; Lee, 2006; Neto, 2002), it could be argued that the effect of red in enhancing sexual attraction is only a reflection of the color's past associative history. Alternatively, biological evolution can also account for the salience of red in sexuality, as red serves to signal sexual preparedness related to the reproductive process (Deschner, Heistermann, Hodges, and Boesch, 2004; Lynn, McCord, and Halliwell, 2007). During the estrus phase, when heightened sexual receptivity is conducive to conception, the genitals of female chimpanzees swell and redden as a sexual cue to males (Buss, 2008). Therefore, it could also be argued that red may suggest higher sexual opportunity for males. Pazda et al. (2012) found parallel mechanisms in humans, showing that sexual receptivity indeed mediates the red effect on women's sexual attractiveness. With regard to males, red usually indicates higher status in many vertebrates (e.g., Setchell and Dixson, 2001; for a short review, see Elliot and Maier, 2012, p. 94), and females evolve to prefer males who are high in status in order to solve the adaptive problem of securing resources during pregnancy (Buss, 2008). Elliot et al. (2010) verified the mediating role of status in red's effect on male

sexual attractiveness. Thus, the effect of red in boosting sexual attractiveness may stem from its concomitance with physiological and psychological processes that are closely related to reproduction. It is crucial to note that although the two sources of red's effects have distinct mechanisms, they are not mutually exclusive and may operate conjointly (Elliot and Maier, 2014). The biological influence might drive or reinforce the cultural association of red, and the cultural norm may generalize or extend its inherent meaning.

Consistent with a biological evolutionary perspective, recently Schwarz and Singer (2013) found a moderator to the red effect. Their study showed that relative to menopausal women, only the younger women were perceived as more sexually attractive when paired with a red rather than white background. If red signals a possibility of conception and fertility and post-menopausal women are unable to conceive, then the color red would lose its status as a signal of reproductive value. Therefore, red would cease to enhance men's sexual attraction. This possibility suggests that sociocultural perspectives alone do not explain the effect of red. If social learning theory is correct, and it is the cultural meaning and the resulting mental association of red that enhances sexual attraction, then red should have an effect on women's attractiveness regardless of whether or not they are menopausal. Additionally, there might be other boundary conditions for the red effect. It could be inferred from above that the factors influencing the perceived reproductive value or future fertility of a target can moderate or change the intensity or directions of the red effect. Consistent with this reasoning, since facial cues of sexual dimorphism (masculine and feminine) are another factor reflecting one's reproductive value in addition to age, they may also moderate the red effect. Therefore, not all individuals would be equally affected by red, and its effect might differ in individuals with different facial traits of masculinity and femininity.

Previous work has already established that the facial cues of sexual dimorphism may be linked with female reproductive value and male status. For female faces, the femininity cues may reflect the level of hormonal secretion, especially estrogen (Law-Smith et al., 2005), implying fertility and an advantage in reproduction (Gesquiere, Wango, Alberts, and Altmann, 2007; Morrison, Clark, Tiddeman, and Penton-Voak, 2010). As for male faces, facial masculinity is positively related to testosterone level (Kasperk et al., 1997; Penton-Voak and Chen, 2004; Pound, Penton-Voak, and Surridge, 2009; Roney, Hanson, Durante, and Maestripieri, 2006), and the level of testosterone is usually associated with status and dominance (e.g., Josephs, Sellers, Newman, and Mehta, 2006). Hence, it came as no surprise that males with masculine facial cues tend to have higher dominance (Boothroyd, Jones, Burt, and Perrett, 2007; Perrett et al., 1998), which is often a signal to status attainment in groups (Anderson and Kilduff, 2009). Taken together, whereas femininity in females often signals higher reproductive value, masculinity in males is associated with dominance and status.

Given that the majority of recent studies on red effect have been conducted on American or European participants (for an exception, see Elliot et al., 2010, Experiment 4), a replication in a different culture is especially important. In China, red has traditionally been rich in meanings. Red was a symbol for status and stood for official titles in ancient official belief systems, and in folk belief systems red is still related to jubilation, auspiciousness, and fortune, such that traditional festivals like the Spring Festival have

always been noted for red decorations (Chen, 2007). Critically, red in China is also closely entwined with images of females and sex. "Red face," a Chinese word, is a byword for young girl, and it could refer to an intimate female friend of a man (yet usually without a sexual relationship) (Shang, 2008). Traditional Chinese weddings are excessive in their use of red, and colloquially "fallen red" refers specifically to the act of "deflowering a virgin" and the blood stain that may be left (Eberhard, 2013). The evolutionary view that the meaning of red may at least partially stem from human biology would be given more credence if we found evidence in China that red can also enhance women's sexual attractiveness, but not general attractiveness, and that this effect is moderated by facial sexual dimorphism cues.

It is currently unknown whether all young targets are perceived as more sexually attractive when presented along with red, regardless of their masculine or feminine cues. It is the intention of this study to investigate this issue. We hypothesize based on evolutionary theory that women with feminine traits are more susceptible to the red effect. Conversely, masculine traits signal relatively lower reproductive value and therefore may lower or even eliminate the red effect. As for men, in line with Elliot et al. (2010), we hypothesize that red only elevates the sexual attractiveness of masculine men. Conversely, if a sociocultural mechanism is the only viable explanation and the red effect stems entirely from the association between red and sex, fertility, or romance, the effect of red should be uniform despite the varying facial cues of sexual dimorphism.

Methods

Participants

A total of 299 students (149 men and 150 women) from a university in Wuhan participated voluntarily for a gift. We deleted the data from 16 participants because they did not follow the instructions, and their responses on the questionnaire were uninterpretable. This resulted in a final sample of 283 participants (139 males and 144 females). The mean age of participants was 20.95 years ($SD = 1.95$), and the range was from 18 to 26 years. All participants were heterosexual and without histories of mental disorder. The participants had normal or corrected to normal vision, and had normal color vision.

Design

The present study adopted a $2 \times 3 \times 2 \times 2$ mixed design, in which three between-subject variables were gender of participants (male, female), clothing color (red, blue, white), and cues of sexual dimorphism (masculine, feminine). The within-subject variable was the gender of the target (male, female). The dependent variables included 1) sexual attractiveness, 2) general attractiveness, and 3) warmth and competence. The sexual attractiveness was only rated on a target of opposite sex with participants, so the analysis of sexual attractiveness involves only a $2 \times 3 \times 2$ between-subject design.

Materials

Unlike previous research on red effects, we generated our stimuli using computer-

synthesized (rather than natural) photos in order to manipulate the sexual dimorphism cues (DeBruine, Jones, Crawford, Welling, and Little, 2010; Wen and Zuo, 2012). First, we created an averaged facial archetype of both sexes using computer graphic techniques. The face images were obtained from a large database of a university containing facial photographs of male and female graduates posed with the same background, uniform luminance, and neutral facial expressions. A total of 321 images comprising 144 men and 177 women were available, from which 32 images were selected for each gender. Images with eyeglasses, moustaches, or jewelry were excluded. All 64 images were used to generate two average images with FantaMorph 4.0 software. We marked 179 key points in each face that, as a whole, delineated the shape and contour of the face and its delicate features. Two photos were averaged along the values registered by the 179 key points, and the averaged images were further averaged in an identical manner. The processes were repeated several times until we obtained a single averaged image for each sex (Wen and Zuo, 2012), which is shown in Figure 1.

Figure 1. Averaged facial archetype of both sexes used in stimuli construction

With the archetype images created, we then chose another photo for each sex from the same database to create the stimuli. The two photos were rated on attractiveness by 87 undergraduates (41 males and 46 females, $M_{age} = 20.77$, $SD = 1.63$) with a 1 (very unattractive) to 7 (very attractive) Likert scale to ensure that the selected photos have a medium level of attractiveness. The results indicated that the facial attractiveness rating of the male photo was 3.94 ($SD = .89$), and the rating of the female photo was 4.03 ($SD = .86$). The two photos were then masculinized and feminized using the sexual dimorphism techniques developed by Perrett et al. (1998). In short, we exaggerated or diminished the feature differences between the two photos and the archetypes to create the masculinized and feminized version of faces for both sexes. The operation was performed in DeBruine et al.'s website www.faceresearch.org. Because the people in the original photos were dressed in a white T-shirt, we created a red and a blue version with Adobe Photoshop CS2, using the color selected from materials described in the study by Meier, D'Agostino, Elliot, Maier, and Wilkowski (2012). The parameters for the colors red and blue were LCh(51.1/57.7/27.8) and LCh(51.6/57.6/278.3), respectively (see Figure 2). The resultant 12 photos constituted the material used in the experiment.

Figure 2. Facial stimuli with different sex, color of clothes and sexual dimorphism cues
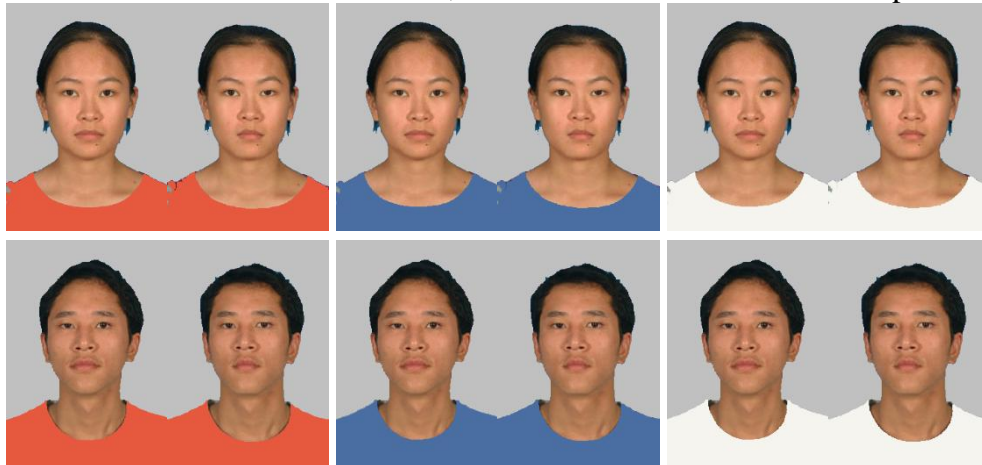
Note. The upper half is female faces and the bottom half is male faces; from left to right is faces with red, blue and white clothes. In each pair, the left image is feminine and the right is masculine.

Measures of dependent variables

All measures were rated on a 1 (very un-…) to 7 (very …) Likert scale.

Sexual attractiveness. We used three items similar to those described in Elliot and Niesta's (2008) study to measure the sexual attractiveness of the target: "How sexually attractive do you think the person is?", "Would you want to have an intimate relationship (euphemism for sexual intercourse in Chinese) with this person?", and "How much do you find this person sexually desirable?" Since the Cronbach's alpha is only .66, we conducted an exploratory factor analysis to test if there is a single factor underlying the three items. The principal axis method was used to extract the common factors. Based on the scree plot, only one factor is the most apposite, accounting for 59.84% of the variance. Moreover, because there was only one factor, no rotation was needed. Based on the results of the exploratory factor analysis, we generated an index of sexual attractiveness using factor scores with the regression method (DiStefano, Zhu, and Mîndrilă, 2009; Grice, 2001). The index is a standardized score with a mean of zero.

General attractiveness. We also used three items to assess perceived general attractiveness: "How attractive do you find this person?", "How good-looking do you think the person is?", and "If you meet this person face to face, how attractive do you think he/she is?" The Cronbach's alpha is .78 based on the opposite sex rating and .81 in the same sex rating. Due to the medium nature of the reliability, we also generated factor scores in each condition instead of simply summing the three items.

We conducted an exploratory factor analysis using the principal axis method to extract common factors for the opposite sex ratings. The scree plot suggested a single factor as most suitable, and it accounted for 69.17% of the total variances. Because there was only one factor, no rotation was needed. Based on the results, we generated a standardized index of perceived general attractiveness using a regression method. The index has a mean of zero.

The case is similar in same sex ratings. Only one factor emerged, which accounted

for 73.07% of total variances. Hence, we generated a similar standardized index.

 Warmth and competence. In addition to attractiveness ratings, the studies by Elliot et al. (2008) and Schwarz et al. (2013) both measured other traits of the targets such as sympathy, intelligence, agreeableness, kindness, etc. Based on the stereotype content model (Fiske, Cuddy, Glick, and Xu, 2002), the current study adopted two traits: competence and warmth. These traits could loosely encapsulate the dimensions of the aforementioned traits. The item for competence is "How competent do you think the person is?", and the item for warmth is "How warm do you think the person is?"

Procedure

 Upon arriving at the laboratory, participants were randomly assigned to one of the 12 conditions formed by the 2×3×2 design and were told that the goal of the experiment is to understand the impression formation process. The participants were then handed a folder containing a facial photo and a questionnaire. The participants were instructed to look at the photo for 5 seconds before filling out the questionnaire, which included demographic information and the measures of dependent variables. After completing the questionnaire, the participants were thanked, debriefed, given a gift, and dismissed. The Committee on Research Ethics approved the entire procedure and materials.

Results

Sexual attractiveness

 We conducted a 2 (participant gender: male vs. female) × 3 (color of cloth: red, blue, and white) × 2 (sexual dimorphism cues: masculine vs. feminine) three-way between-subject ANOVA on the standardized index of sexual attractiveness. The results indicated a significant main effect of participant gender, $F(1,271) = 7.80$, $p = .006$, $\eta_p^2 = .03$. Specifically, male participants ($M = .14$, $SD = .81$) found the opposite sex target more sexually attractive than did female participants ($M = -.13$, $SD = .81$). The main effect of clothes color was marginally significant, $F(2,271) = 2.80$, $p = .06$, $\eta_p^2 = .02$. Whereas participants found the target wearing red ($M = .15$, $SD = .90$) slightly more sexually attractive than the one wearing white ($M = -.13$, $SD = .76$) ($p = .06$), the differences between the targets wearing blue ($M = -.02$, $SD = .82$) vs. white ($p = .75$), and blue vs. red ($p = .37$) were both not significant. The main effect of sexual dimorphism cues did not reach significance, $F(1,271) = 1.42$, $p = 0.23$, $\eta_p^2 < 0.01$.

 The two-way interaction between gender and sexual dimorphism cues was significant, $F(1,271) = 6.32$, $p = .01$, $\eta_p^2 = .02$, and further analysis revealed that compared to masculine targets, male participants rated feminine targets as more sexually attractive, $F(1,271) = 6.74$, $p = .01$, $\eta_p^2 = .02$, but ratings from female participants did not differ, $F(1,271) = .89$, $p = .35$, $\eta_p^2 < .01$. All the remaining two-way interactions were insignificant ($ps > .17$).

 However, in accordance with our hypothesis we did find a significant three-way interaction among gender, color, and sexual dimorphism cues, $F(2,271) = 3.10$, $p = .047$, $\eta_p^2 = .02$. To decompose the three-way interaction, we first tested the two-way interactions (or simple interaction) between color and sexual dimorphism separately under male and

female conditions. For male participants, the two-way interaction was not significant, $F(2,271) = 1.00$, $p = .37$, $\eta_p^2 < .01$, but it indicated a trend toward significance for female participants, $F(2,271) = 2.58$, $p = .08$, $\eta_p^2 = .02$. Female participants rated masculine targets with red clothing more sexually desirable than feminine red targets, $F(1,271) = 5.43$, $p = .02$, $\eta_p^2 = .02$, and showed no such preference for masculinity in other color conditions ($ps > .5$). To directly test the red effect, we planned a contrast between target with red and the other two colors, and found a trend of red to elevate the sexual attractiveness ratings of masculine targets, as rated by women, though it only reach marginal significance, $F(1,271) = 3.25$, $p = .07$, $\eta_p^2 = .01$.

Alternately, decomposing the three-way interaction from the perspective of sexual dimorphism proved to be clearer. The two-way interaction between gender and color of clothes was not significant under the masculine condition, $F(2,271) = .45$, $p = .64$, $\eta_p^2 < .01$, yet it was significant under the feminine condition, $F(2,271) = 4.50$, $p = .01$, $\eta_p^2 = .03$.

We examined the second-order simple effect associated with feminine conditions using Sidak corrections. The difference between photos with different colors was significant when rated by men, $F(2,271) = 3.96$, $p = .02$, $\eta_p^2 = .03$. Consistent with our hypothesis, we planned a contrast between photos with red and the mean of the other two colors, and found that the red target received higher ratings on sexual attractiveness from male participants than targets with the two other colors, $F(1,271) = 7.81$, $p = .006$, $\eta_p^2 = .03$. However, the difference was completely nonsignificant when rated by women, $F(2,271) = 1.56$, $p = .21$, $\eta_p^2 = .01$ (see Figure 3).

Figure 3. Sexual attractiveness as a function of sexual dimorphism, color of clothes, and participants' gender
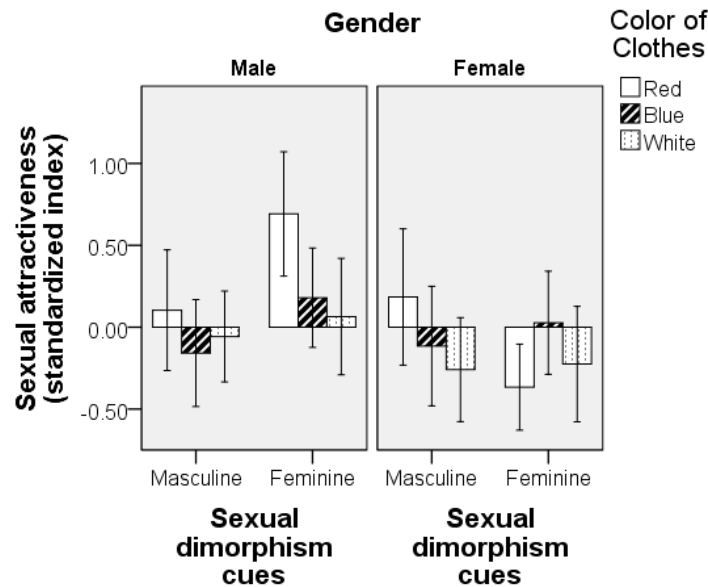
Note. Error bars represent 95% CI.

Together, the results suggest that the red effect exists only for feminine women rated by male participants, but not for masculine women. Furthermore, we found a

discernible trend for red to enhance the sexual attractiveness of masculine men in comparison with feminine men, as rated by female participants, but the trend did not reach significance.

General attractiveness

We conducted a 2 (participant gender: male vs. female) × 3 (color of cloth: red, blue, and white) × 2 (sexual dimorphism cues: masculine vs. feminine) × 2 (target gender) four-way mixed design ANOVA on the standardized index of general attractiveness. The target gender is the within-subject variable, and the three other variables are all between-subject. The analysis showed a significant main effect of color of clothes, $F(2,270) = 4.64$, $p = .01$, $\eta_p^2 = 0.03$. Post-hoc analysis with Sidak correction found that, overall, participants thought targets wearing blue clothes generally were more attractive than ones wearing white ($M_{Blue} - M_{White} = .30$, $SE = .10$, $p = .008$), and no significant differences were found between red and blue, or between white and red ($ps > .13$).

Additionally, the three-way interaction among target gender, participant gender, and sexual dimorphism cues was significant, $F(1,270) = 11.00$, $p = .001$, $\eta_p^2 = 0.04$. Decomposing the three-way interaction based on the target gender, we found that the two-way interaction between participant gender and sexual dimorphism was significant only for same-sex targets, $F(1,270) = 10.14$, $p = .002$, $\eta_p^2 = 0.04$, but not for opposite sex targets, $F(1,270) = .92$, $p = .34$, $\eta_p^2 < 0.01$. Further analyzing the second-order simple effects under the same-sex target condition, we found that male participants rated feminine same-sex targets ($M = -.24$, $SE = .11$) as less generally attractive than masculine same-sex targets ($M = .16$, $SE = .10$), $F(1,270) = 7.25$, $p = .008$, $\eta_p^2 = 0.03$; meanwhile, female participants perceived feminine same-sex targets ($M = .21$, $SE = .10$) as more generally attractive than masculine ones ($M = -.06$, $SE = .11$), though the difference was only marginally significant, $F(1,270) = 3.25$, $p = .07$, $\eta_p^2 = 0.01$, as shown in Figure 4.

Figure 4. Perceived general attractiveness as a function of sexual dimorphism, color of clothes, and participants' gender
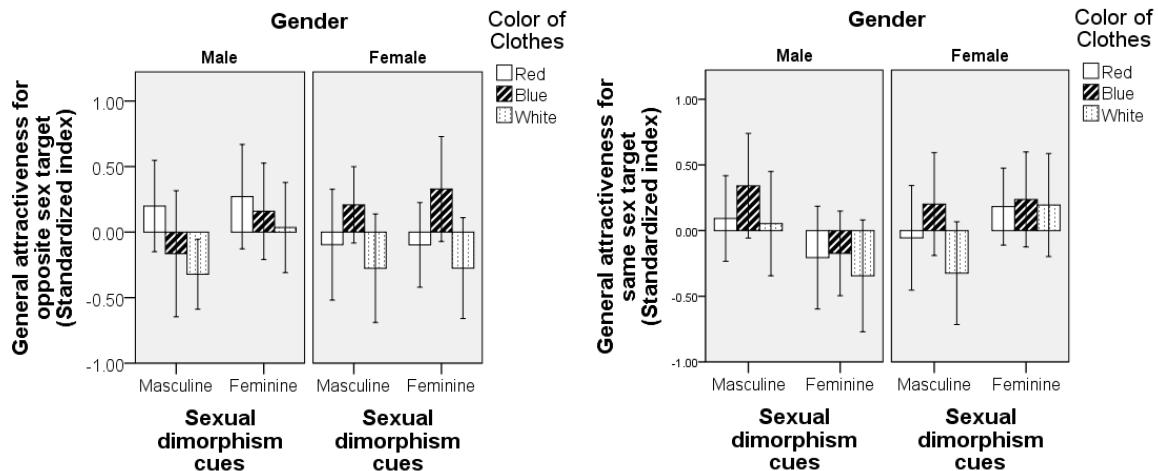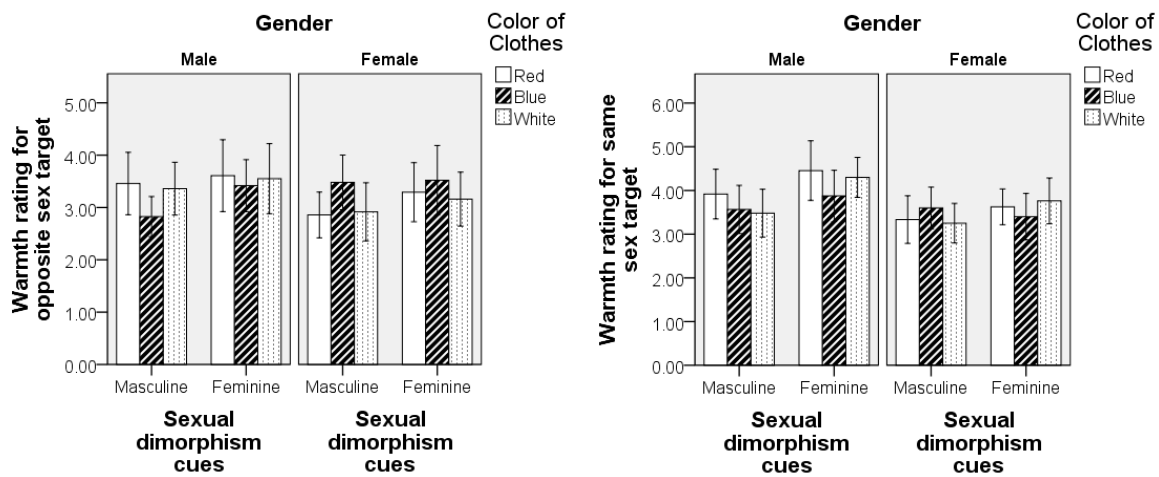

Note. Gender of the target: the left is opposite sex, the right is same sex. Error bars represent 95% CI.

All the other main effects, two-way interactions, three-way interactions and four-way interaction were insignificant ($ps > .1$).

Warmth

We conducted a similar 2 (participant gender: male vs. female) × 3 (color of cloth: red, blue, and white) × 2 (sexual dimorphism cues: masculine vs. feminine) × 2 (target gender) four-way mixed design ANOVA on warmth ratings. The target gender is a within-subject variable, and the rest are between-subject variables. As shown in Figure 5, the results revealed a significant main effect of target gender, $F(1,270) = 20.73$, $p < .001$, $\eta_p^2 = .07$; namely, participants rated the opposite sex ($M = 3.29$, $SE = .08$) as less warm than same-sex targets ($M = 3.71$, $SE = .07$). The main effect of participant gender was also significant, $F(1,270) = 6.23$, $p = .01$, $\eta_p^2 = .02$. Compared with female participants ($M = 3.35$, $SE = .08$), male participants tended to give higher warmth ratings to all the targets ($M = 3.65$, $SE = .09$). However, the two-way interaction between participant gender and target gender was not significant, $F(1,270) = 2.13$, $p = .15$, $\eta_p^2 = .01$. Furthermore, we found a marginally significant two-way interaction between color of clothes and participant gender, $F(2,270) = 2.70$, $p = .07$, $\eta_p^2 = .02$. Further analysis of simple effects showed that male participants found targets wearing red warmer than did female participants, $F(1,270) = 7.48$, $p = .007$, $\eta_p^2 = .03$, whereas for targets wearing white, male participants gave only slightly warmer ratings than did female participants, $F(1,270) = 3.69$, $p = .06$, $\eta_p^2 = .01$; for targets wearing blue, there was no significant gender difference, $F(1,270) = .15$, $p = .70$, $\eta_p^2 < .01$. Alternately, the differences across color of clothes under both male and female conditions were all insignificant, $ps > .11$. Planned contrasts between red clothing and the two other colors reached marginal significance in male participants, $F(1,270) = 2.87$, $p = .09$, $\eta_p^2 = .01$, but not in females participants ($p = .55$), suggesting a slight tendency for men to rate red targets warmer than other targets. All the remaining main effects, two-way interactions, three-way interactions, and four-way interaction were insignificant, $ps > .14$.

Figure 5. Warmth rating as a function of sexual dimorphism, color of clothes and participants' gender
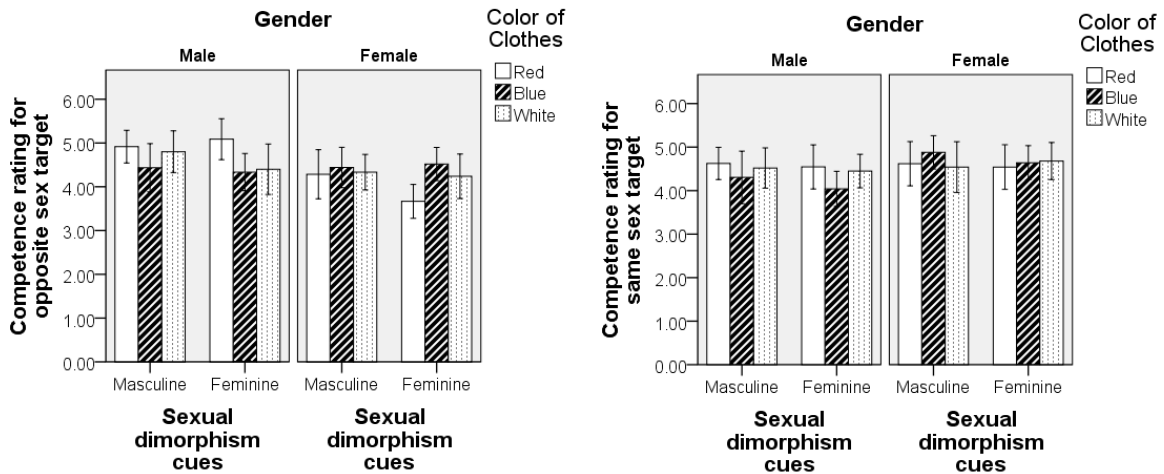

Note. Gender of the target: the left is opposite sex, the right is same sex. Error bars represent 95% CI.

Competence

A similar four-way mixed-design ANOVA was conducted on competence ratings. As seen in Figure 6, the results showed a significant two-way interaction between participant gender and target gender, $F(1,270) = 14.46$, $p < .001$, $\eta_p^2 = .05$. Specifically, rating opposite sex targets, male participants tended to give higher competence ratings ($M = 4.66$, $SE = .09$) than did female participants ($M = 4.25$, $SE = .09$), $F(1,270) = 9.81$, $p = .002$, $\eta_p^2 = .04$, yet when rating same-sex targets, male participants tended to give lower competence rating ($M = 4.41$, $SE = .09$) than female participants ($M = 4.65$, $SE = .09$), though it only reached marginal significance, $F(1,270) = 3.27$, $p = .07$, $\eta_p^2 = .01$. In addition, the two-way interaction between color of clothes and participant gender was significant, $F(2,270) = 6.09$, $p = .003$, $\eta_p^2 = .04$. Simple effects analysis showed that the difference across color of clothing was significant in male participants, $F(2,270) = 4.29$, $p = .02$, $\eta_p^2 = .03$, but not in female participants, $F(2,270) = 2.00$, $p = .14$, $\eta_p^2 = .02$. Planned contrasts between the color red and the two other colors in the male condition showed that male participants found targets in red more competent than other targets, $F(1,270) = 6.16$, $p = .01$, $\eta_p^2 = .02$.

All other main effects, two-way interactions, three-way interactions and four-way interaction were not significant, $ps > .18$.

Figure 6. Competence rating as a function of sexual dimorphism, color of clothes, and participants' gender

Note. Gender of the target: the left is opposite sex, the right is same sex. Error bars represent 95% CI.

Discussion

The present experiment provides strong support for our hypothesized moderation of sexual dimorphism cues on the red effect and also provides a replication of the red effect in a Chinese context. The color red was shown to have a boosting effect on the sexual attractiveness of women with feminine facial traits when perceived by male participants. However, women with masculine facial traits did not benefit from red clothes. These findings could be explained from an evolutionary biological perspective, as feminine traits

in women signal higher reproductive value. The most critical information in mating with the opposite sex would be gleaned from many cues. The perception of heightened reproductive value by presenting both red clothes and feminine traits enhances the sexual attractiveness of the female. In contrast, masculine traits in women may signal relatively lower reproductive value and conflict with the information about fertility presumably imparted by the color red (Law-Smith et al., 2005; Morrison et al., 2010), thereby offsetting or canceling the red effect.

Men with masculine facial cues were perceived by female participants as more sexually attractive when wearing red clothes, but this comparison only reached marginal significance. This tendency is consonant with our hypothesis. Because masculinity and red both signal status in males, and females are likely to favor males with status and resources, in the current study we indeed showed that women tend to rate men with a red-and-masculinity combination as more sexually desirable. Meanwhile, two factors may have contributed to its failure to reach significance. First, the association between the color red and males is multi-faceted. Although red may enhance men's facial attractiveness, a man associated with too much red could be perceived as aggressive (Stephen, Oldham, Perrett, and Barton, 2012). This is further supported by the link between the facial reddening of a man and the blood suffusion brought about by anger or aggression (Drummond and Quah, 2001). Second, masculine facial cues often reflect levels of testosterone (Penton-Voak and Chen, 2004; Roney et al., 2006). Testosterone is related to various personality traits that may have negative connotations, such as dominance or aggressiveness (Boothroyd et al., 2007; Hughes, Dispenza, and Gallup Jr., 2004; Perrett et al., 1998), and the perception of these traits may be more evident when targets are wearing neutral facial expressions (Hareli, Shomrat, and Hess, 2009; Tracy and Beall, 2011), as in the current study. Thus, the masculine cues in the current experiment may have triggered contradictory perceptions of the male target, which, as a result, could have offset the red effect of enhancing the sexual attractiveness of men. Given the dearth of studies on how red affects male sexual attractiveness, future research is needed to clarify the red effect across genders.

The present study also measured the perceived general attraction of the targets. The results demonstrated that male participants did not rate the opposite sex target paired with red as higher on the three measures, relative to the other colors. This result is generally consistent with previous studies (Elliot et al., 2010, 2013; Schwarz and Singer, 2013), yet it should be noted that Elliot and Niesta (2008) did document an effect of red on general attractiveness, though it was smaller in effect size. This slight disparity in results warrants further theoretical and empirical consideration.

Averaging over three colors, we found that whereas female participants did not favor either feminine or masculine women, the male participants perceived feminine men as less generally attractive. This could lend support to the gender dichotomization tendency that is characteristic of a male gender role (Bosson, and Michniewicz, 2013).

As for warmth and competence ratings, we found that, averaging over the sexual dimorphism cues, male participants tended to rate female targets wearing red as warmer and more competent than the targets wearing white or blue. This result on warmth and competence ratings slightly deviated from ratings on other related trait words in Elliot et al. (2010). Considering that it was not moderated by sexual dimorphism cues, other

mechanisms may have been responsible, such as halo effect. The close link between red and general positivity in Chinese culture, along with the status of red as being especially tied with females in Chinese culture, may also exert influences (Eberhard, 2013; Shang, 2008).

This study also has some limitations. First, as in Schwarz and Singer (2013), we used solely self-report ratings that are well documented to be susceptible to social desirability biases, especially on delicate issues such as direct judgment of others' attractiveness and of sexual interest toward a stranger. It could be more accurate and precise to employ biological measures to index one's sexual attraction to the targets.

In same sex ratings, we measured only perception of general attraction, warmth, and competence, dropping sexual attraction. It is counterintuitive to measure heterosexuals' sexual attraction to same-sex targets. Nevertheless, in future studies, same or modified items also measuring the perceived sexual attractiveness of same-sex participants could aid in the discriminant validity of the current measures.

Furthermore, a study to examine the effects of red in different mating or task contexts would be fruitful. Research has already suggested that the red effect may have completely different meanings in working or achievement contexts (Elliot and Maier, 2012, 2014; Elliot, Maier, Moller, Friedman, and Meinhardt, 2007). Thus, the moderation of sexual dimorphism on the red effect may be further moderated by context (i.e., perhaps the feminine female paired with red would be perceived as less competent in working conditions).

So far, studies about the red effect have focused on the perceivers, though it is likely that the color of clothing may also exert influences over the wearers. It is plausible that the color of clothing may change the sexual awareness of its wearer, and it could be the case that wearing red clothes is a reflection of the sexual intention of the wearer from the beginning. The combination of data from the red-wearer and the perceiver would better capture the significance of red and would be an interesting avenue for future studies.

Another limitation of this study is that we did not directly test the alternative explanations. For example, one might argue that the red stimuli simply activated mental representation of traditional wedding ceremonies in China or the "red-light" district in the West due to cultural schema or stereotypes. Female newlyweds or female sex workers are supposed to have more feminine traits. Consistent with this argument, the reason that the red effect is specific to feminine women could be easily sought in social conditioning rather than evolution. Though such reasoning has certain inherent difficulties (e.g., Why did red not invoke an image of the red flag, but activated images of the "red-light" district?), we were not able to test these issues directly in this study. The cultural mechanism cannot be excluded from the red effect on sexual attraction, and it may operate at a different level and exert influence through social learning and acculturation processes, such as through the perceived sexual receptiveness of the individual wearing red clothes (Pazda et al., 2012). Moreover, Roberts et al. (2010) found that in certain settings, black dressing elevated perceived sexual attractiveness as well, which undermines the uniqueness of red and its purported evolutionary underpinnings. In light of these considerations, further research is needed to clarify the contributions of both cultural and biological mechanisms.

The simple perceptual mechanism that reduces the color effect to color contrast or

luminance, as in Schwarz and Singer (2013), can be ruled out because the color configuration used in the current study is identical to previous research, and this interpretation could not explain the moderation role of sexual dimorphism cues. However, we did not use a spectrophotometer to check the color parameters of printed materials; this should be corrected in future replications.

Collectively, previous research has shown that red stimuli could enhance an individual's sexual attraction. The current investigation adds to this literature by showing that this effect is moderated by the facial sexual dimorphism cues of the targets. Furthermore, it is the first study to systematically examine the moderating roles of facial cues in explaining the red effect. This finding adds to the growing literature on the red effect and its boundary conditions, and the implications may stimulate future research.

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