

# Red and Romantic Rivalry: Viewing Another Woman in Red Increases Perceptions of Sexual Receptivity, Derogation, and Intentions to Mate-Guard

Personality and Social Psychology Bulletin  
2014, Vol. 40(10) 1260–1269  
© 2014 by the Society for Personality and Social Psychology, Inc  
Reprints and permissions:  
sagepub.com/journalsPermissions.nav  
DOI: 10.1177/0146167214539709  
pspb.sagepub.com  


Adam D. Pazda<sup>1</sup>, Pavol Prokop<sup>2,3</sup>, and Andrew J. Elliot<sup>1</sup>

## Abstract

Research has shown that men perceive women wearing red, relative to other colors, as more attractive and more sexually receptive; women's perceptions of other women wearing red have scarcely been investigated. We hypothesized that women would also interpret female red as a sexual receptivity cue, and that this perception would be accompanied by rival derogation and intentions to mate-guard. Experiment 1 demonstrated that women perceive another woman in a red, relative to white, dress as sexually receptive. Experiment 2 demonstrated that women are more likely to derogate the sexual fidelity of a woman in red, relative to white. Experiment 3 revealed that women are more likely to intend to guard their romantic partner from a woman wearing a red, relative to a green, shirt. These results suggest that some color signals are interpreted similarly across sex, albeit with associated reactions that are sex-specific.

## Keywords

color, red, sexual receptivity, derogation, competition

Received November 25, 2013; revision accepted May 23, 2014

An emerging line of research has shown that women displaying red on their lips or skin (Re, Whitehead, Xiao, & Perrett, 2011; Stephen & McKeegan, 2010) or wearing red clothing (Elliot & Niesta, 2008; Guéguen, 2012a; Pazda, Elliot, & Greitemeyer, 2012; Roberts, Owen, & Havlicek, 2010) appear more attractive and sexually desirable to men. Red clothing on women has also been shown to elicit approach-oriented behavior from men, including responding to personal ads (Guéguen & Jacob, 2013), sitting closer (Niesta Kayser, Elliot, & Feltman, 2010), offering a ride to hitchhikers (Guéguen, 2012b), and leaving a larger tip (Guéguen & Jacob, 2014). Pazda, Elliot, and Greitemeyer (2012, 2014) and Guéguen (2012a) additionally demonstrated that men perceive a display of red by a woman to be a signal of sexual receptivity. The research to date on female red has focused nearly exclusively on men's impressions of women, largely neglecting to consider women's impressions of other women. We sought to rectify this oversight in the present research with three experiments focused on how women perceive and react toward women wearing red clothing.

## Red and Perceived Sexual Receptivity

A number of studies have documented that men tend to overestimate the sexual intentions of women (Abbey, 1982;

Abbey, Cozzarelli, McLaughlin, & Harnish, 1987; Haselton, 2003). As such, it is possible that men's linking of red to women's sexual receptivity may just be another example of wishful thinking—perceiving a cue of sexual intent when no such cue is actually present. If so, the red-receptivity link would likely be specific to male perceivers, as female perceivers do not share this motivated bias. However, some evidence suggests that women indeed display more red when sexually receptive (which we detail in the following paragraphs), indicating that men's perceptions are at least partially grounded in accurate observation. Thus, it seems likely that the red-receptivity link will be present for female perceivers as well.

Although the association between red and female sexual receptivity is undoubtedly due, in part, to the repeated societal pairing of red and female sexuality (e.g., cosmetics, lingerie, red light districts), there are also data suggesting a

<sup>1</sup>University of Rochester, NY, USA

<sup>2</sup>Trnava University, Slovakia

<sup>3</sup>Slovak Academy of Sciences, Bratislava, Slovakia

### Corresponding Author:

Adam D. Pazda, Department of Clinical and Social Sciences in Psychology, University of Rochester, 488 Meliora Hall, Rochester, NY 14627, USA.  
Email: apazda@gmail.com

biological basis for the red-receptivity link. Specifically, blushing on the upper chest, neck, and face are common physiological responses that accompany female sexual excitation (Changizi, 2009; Eibl-Eibesfeldt, 1989; Katchadourian, 1984), and women's sexual interest and arousability appear to be elevated at peak fertility (Bullivant et al., 2004; Dennerstein et al., 1994; Haselton & Gangestad, 2006; Wallen & Rupp, 2010). There is also some evidence that women's facial skin becomes slightly redder at midcycle (Oberzaucher et al., 2012; cf. Samson, Fink, & Matts, 2011). Furthermore, during peak fertility, women tend to wear more revealing clothing (Durante, Li, & Haselton, 2008; Haselton, Mortezaie, Pillsworth, Bleske-Rechek, & Frederick, 2007), which may allow the red of sexual excitation to be more prominently displayed at this time.

In the behavioral domain, men tend to seek short-term mates who are physically attractive and sexually available, and women alter their physical appearance in line with these preferences as a self-promotion strategy (Buss, 1988; Buss & Dedden, 1990; Walters & Crawford, 1994). Both correlational and experimental research has shown that one particular way in which women alter their appearance to convey sexual availability is by wearing red clothing. For example, naturalistic observations of dating websites have revealed that women seeking casual sex are more likely to wear red in their profile picture than women seeking other types of relationships, such as friendship or marriage (Elliot & Pazda, 2012). Furthermore, the likelihood of dressing in red or pink clothing increases for women during peak fertility (Beall & Tracy, 2013; Tracy & Beall, 2014; also see Guéguen, 2012c). Other empirical work has shown that situational manipulations, such as introducing a mating-relevant context (without necessarily being overtly sexual), can increase women's likelihood of wearing red. For instance, female participants were more likely to wear a red shirt when expecting to meet an attractive man, relative to an unattractive man or a woman (Elliot, Greitemeyer, & Pazda, 2013). In addition, women have a preference for wearing red clothing when the probability of encountering a mate is high (e.g., going to a party), relative to low (e.g., visiting one's grandparents; Prokop & Hromada, 2013).

Given the aforementioned evidence, it seems likely that women, like men, would link female red with sexual receptivity. Women may witness this association through the pairing of red with sexual themes in society, they may witness this relation through physiological changes on their own faces and bodies or on those of other women, or they may realize that they themselves tend to wear red clothing when sexually interested and infer that other women do the same. Thus, we predict that women who see another woman in red will perceive her as more sexually receptive.

### Red and Intrasexual Competition

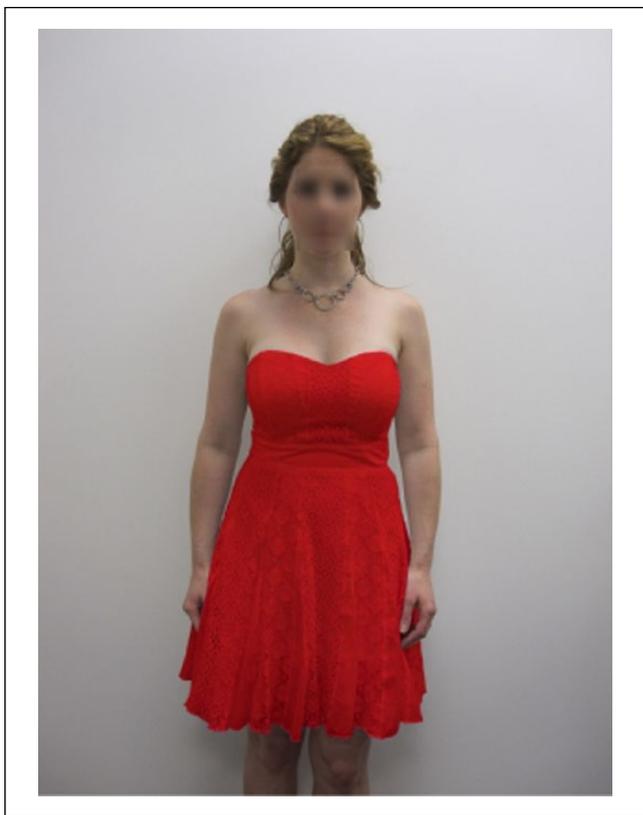
Intrasexual competition for mates is common in mammalian species for both males and females, although competitive

strategies differ substantially across sex (Buss, 1988; Darwin, 1871; Trivers, 1972). Using indirect aggression toward same-sex peers, such as derogating romantic rivals, is a strategy often utilized by human females to reduce their rival's mate value (Buss, 2011; Buss & Dedden, 1990; Fisher, 2004; Vaillancourt, 2005). This derogation is not random; rather, it is typically directed toward specific features that men value in a partner.

Throughout human evolution, sexual fidelity has emerged as a characteristic that men value in mates, especially for long-term relationships (Buss, 1989; Schmitt & Buss, 1996). Men can never be entirely certain of their paternity, which resulted in pressure to mate with women whom they were confident would not simultaneously mate with others. Choosing mates who are sexually exclusive reduces the possibility of men investing in offspring that are not genetically related to them (Barber, 2000). Thus, for women, derogating a competitor's sexual fidelity can be an effective strategy for increasing one's mate value relative to the competition (Fisher, Cox, & Gordon, 2009; Schmitt & Buss, 1996). However, derogating female characteristics that have little relevance to males' mate preferences, such as financial resources, should not be effective for increasing one's mate value relative to others' (Buss, Shackelford, Choe, Buunk, & Dijkstra, 2000; Walters & Crawford, 1994). In the present research, we hypothesized that red clothing would mark a woman as a sexual competitor and induce strategic competitive behavior toward that woman. Specifically, we predicted that women would derogate a red-clad woman's sexual fidelity, but not her financial resources.

Intrasexual competition involves more than just attracting mates and derogating rivals. Females who successfully procure a mate can reap the maximum benefits from the relationship if the mate is retained over time (Buss, 1988, 1989). The importance of mate retention throughout human evolution has led women to be able to detect cues to competitors' sexual interest and availability. Women who could pick up on other's sexual signals would likely have more success retaining their mates from poachers, as they could actively keep these women at a distance via social exclusion (Benenson, 2009; Buss et al., 2000). Vaillancourt and Sharma (2011) demonstrated that women are particularly likely to do this to peers dressed in provocative clothing. Specifically, female participants were less likely to introduce their romantic partner to another woman dressed in sexy clothing, and were less likely to let their partner spend time alone with her. If a woman in red clothing, like a woman in provocative clothing more generally, is perceived as a competitive threat, we should see female participants expressing their intentions to guard their partner from her (see Fink, Klappauf, Brewer, & Shackelford, 2014, for a similar line of reasoning).

In sum, in the present research, we tested the following three hypotheses regarding women's perception of and reactions toward another woman in red (relative to other colored) clothing:



**Figure 1.** The picture used for the color manipulation in Experiments 1 and 2 (the face of the female target was intact in the experiments but is blurred here to protect privacy).

Note. The dress color was red or white.

**Hypothesis 1:** Women will perceive another woman wearing red as sexually receptive.

**Hypothesis 2:** Women will explicitly derogate the sexual fidelity (but not financial resources) of another woman wearing red.

**Hypothesis 3:** Women in a committed romantic relationship will intend to guard their mate from another woman wearing red.

## Experiment 1

In Experiment 1, we used a web design to test whether women would perceive another woman wearing red, relative to a neutral color, as more sexually receptive. We chose white as an unobtrusive, achromatic contrast color.

### Method

One hundred ninety-six women were recruited on Amazon's Mechanical Turk for a modest cash payment. The mean age of participants was 30 (range = 18-65). Participant ethnicity was as follows: 99 Asian/Pacific Islander, 6 Black/African American, 64 Caucasian, 8 Hispanic, 3 Native American,

and 16 multi-racial/unspecified. The sample size for this and the subsequent experiments was determined as follows: We estimated .80 power for a medium ( $d = .50$ ) effect size (which yields  $n = 128$ ), and then made sure to acquire samples larger than this for each study, given our (admittedly rough) anticipation of effects in the medium-to-small range. In each experiment, all data were collected before any analyses were conducted, and all data exclusions, manipulations (i.e., experimental conditions), and variables analyzed are reported. Participation in this and all subsequent experiments was restricted ex ante to women without an experiment-relevant color vision deficiency.

Participants followed a web link to access the study. A welcome screen indicated that the study was about forming impressions of others, and that participation would entail viewing a photograph of another individual followed by a questionnaire assessing their impression of that individual. The photograph was of a moderately attractive woman in her late-20s with light brown hair ( $M$  attractiveness = 5.5 on a 1-9 scale; see Pazda et al., 2014), standing in front of a light gray background. Participants were randomly assigned to view the target in either a red ( $n = 98$ ) or white ( $n = 98$ ) knee-length dress; aside from the dress color, the pictures were identical (see Figure 1). The color in the photograph was manipulated using Adobe Photoshop CS2. Specifically, we created a photo filter covering the entire surface area of clothing. Then, we manipulated the color of the filter, which allowed other aspects of the clothing, such as texture, to remain unchanged. The dress color in the original photograph was white, but we still applied the photo filter to the white condition to eliminate the possible confound of comparing a manipulated picture to an unmanipulated picture. The photograph was 450 pixels long by 350 pixels wide and centered on the computer screen. Participants were instructed to look at the photograph for 5 s and then proceed to the questionnaire.

Perceived sexual receptivity was assessed with Pazda et al.'s (2012) four-item measure (e.g., "This person is interested in sex"). Responses were made by moving a slider anchored from "No, not at all" to "Yes, definitely." Slider values ranged from 0 to 100 in increments of 1; the scale did not include a midpoint and participants were blind to the exact numerical value of the slider. Scores were averaged to form a composite index ( $\alpha = .91$ ).

## Results and Discussion

An independent-samples  $t$  test revealed an effect of color on perceived sexual receptivity,  $t(194) = 2.37$ ,  $p = .019$ ,  $d = .34$ , 95% confidence interval (CI) = [1.37, 15.02]. Participants in the red condition rated the woman as more sexually receptive ( $M = 49.26$ ,  $SD = 22.41$ ) than participants in the white condition ( $M = 41.06$ ,  $SD = 25.91$ ). Sixty-nine percent of participants reported being involved in a committed romantic relationship. We tested whether relationship status (committed

vs. single) moderated the red effect. The interaction was not significant ( $F = 0.14, p = .71$ ), indicating that the effect of red on perceived sexual receptivity was similar for single participants and those involved in a committed relationship.<sup>1</sup> Thus, Experiment 1 provides initial support that women perceive other women in red as sexually receptive.

## Experiment 2

In Experiment 2, we sought to replicate and extend the results from the previous experiment. Specifically, we wanted to investigate whether female participants would derogate another female wearing red, relative to white, clothing. It could be argued that the results obtained from the previous experiment can be construed as a form of derogation. Sexual receptivity and promiscuity are closely related concepts, and suggesting that other women are promiscuous may be a strategy for undermining their mate value (Buss & Dedden, 1990). However, we are hesitant to draw this conclusion because rating another woman as sexually receptive does not necessarily entail the same negative evaluation as does calling a woman promiscuous. We address this issue in the present experiment. We predicted that women would derogate characteristics of a woman dressed in red that are typically valued by mates, such as her sexual fidelity, but not characteristics that are typically less valued by mates, such as her financial resources. We also tested whether inducing a competitive mating context would moderate the degree to which women viewed the target as sexually receptive or derogated her. We anticipated that the red effect would be especially strong when participants were primed with competition for mates.

## Method

Three hundred twenty-seven women were recruited on Amazon's Mechanical Turk for a modest cash payment. Participant ethnicity was as follows: 110 Asian/Pacific Islander, 13 Black/African American, 131 Caucasian, 3 Hispanic, and 70 multi-racial/unspecified.

The study procedure was the same as that of the previous experiment with two exceptions. First, we added a manipulation that made a competitive mating context salient or not. Specifically, we had participants randomly assigned to the competitive mating context view the following text, displayed directly above the target photograph: "Please imagine that the person in this photograph is competing against you for the attention of an attractive man." Participants randomly assigned to the non-competitive mating context did not view this statement. This resulted in a  $2 \times 2$  between-subjects design, whereby participants were exposed to a red-competitive context ( $n = 84$ ), red-no competitive context ( $n = 75$ ), white-competitive context ( $n = 98$ ), or white-no competitive context ( $n = 70$ ) photograph. The same target photographs from the previous experiment were

used. Second, we assessed perceived sexual receptivity (using the same measure from the prior experiment,  $\alpha = .91$ ), as well as two additional variables. Specifically, we assessed whether participants would derogate two different characteristics of the target female. *Derogation of fidelity* was assessed with Buss and Dedden's (1990) two-item measure (e.g., "I would guess that this woman cheats on men") using a slider anchored from "No, not at all" to "Yes, definitely"; scores were averaged to form a composite index ( $\alpha = .87$ ). *Derogation of financial resources* was assessed with Buss and Dedden's three-item measure (e.g., "I would guess that this woman has no money") using a slider anchored from "No, not at all" to "Yes, definitely"; scores were averaged to form a composite index ( $\alpha = .92$ ). For each measure, slider values ranged from 0 to 100 in increments of 1, although participants were blind to the exact numerical value of the slider.

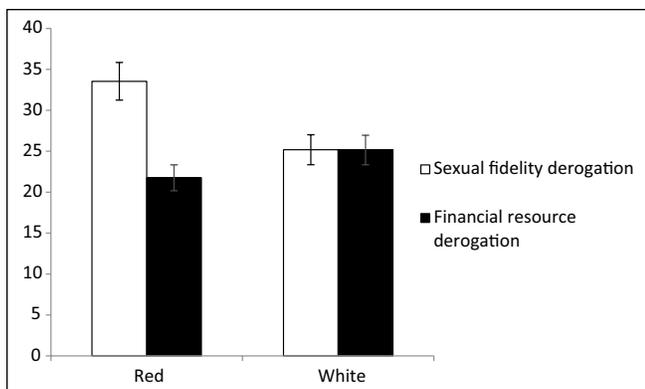
## Results and Discussion

A  $2 \times 2$  (Color  $\times$  Competitive context) ANOVA revealed a significant main effect of color on perceived sexual receptivity,  $F(1, 323) = 8.71, p = .003, d = .33, 95\% \text{ CI} = [2.63, 12.95]$ . Participants in the red condition rated the woman as more sexually receptive ( $M = 46.02, SD = 23.84$ ) than participants in the white condition ( $M = 38.23, SD = 23.58$ ). These results replicate those obtained in the previous experiment. We also observed a main effect of context on perceived sexual receptivity,  $F(1, 323) = 5.30, p = .022, d = .23, 95\% \text{ CI} = [0.31, 10.77]$ . Participants who were exposed to a competitive mating context perceived the target female as more sexually receptive ( $M = 44.48, SD = 23.33$ ) than those who were not ( $M = 38.95, SD = 24.53$ ). The interaction between color and context was not significant ( $F = 1.64, p = .20$ ).

We conducted a second ANOVA with sexual fidelity derogation as the dependent variable. A main effect emerged for color condition,  $F(1, 323) = 8.46, p = .004, d = .32, 95\% \text{ CI} = [2.60, 14.12]$ , such that participants derogated the sexual fidelity of the target dressed in red ( $M = 33.54, SD = 29.04$ ) more than the target dressed in white ( $M = 25.18, SD = 23.57$ ). A main effect of context also emerged,  $F(1, 323) = 5.57, p = .019, d = .24, 95\% \text{ CI} = [0.63, 12.28]$ , such that participants exposed to the competitive mating context derogated the target's sexual fidelity ( $M = 32.15, SD = 27.12$ ) more than those who were not ( $M = 25.70, SD = 25.77$ ). The Color  $\times$  Context interaction was not significant,  $F = 0.33, p = .56$ .

Next, we conducted an ANOVA with financial resource derogation as the dependent variable. Neither of the main effects nor their interaction was significant ( $F_s < 2.06, p_s > .15$ ).

Finally, we conducted a mixed-model ANOVA to test whether sexual fidelity derogation differed from financial resource derogation within each color condition. Derogation type was treated as a within-subjects factor and color condition was treated as a between-subjects factor. The derogation



**Figure 2.** Derogation of sexual fidelity and financial resources as a function of color condition (red vs. white) in Experiment 2.

type by color condition interaction was significant,  $F(1, 323) = 13.13, p < .001$ . Participants assigned to the red condition derogated the target's sexual fidelity ( $M = 33.54, SD = 29.04$ ), relative to the target's financial resources ( $M = 21.75, SD = 19.90$ ),  $t(159) = 5.11, p < .001, d = .42, 95\% CI = [7.23, 16.25]$ . Participants assigned to the white condition showed no difference between sexual fidelity derogation ( $M = 25.18, SD = 23.57$ ) and financial resource derogation ( $M = 25.15, SD = 23.28$ ),  $t(165) = 0.02, p = .99$  (see Figure 2).

Experiment 2 provides further support for our hypotheses regarding women's impressions of and reactions to another woman in red. We replicated the effect of red on perceived sexual receptivity obtained in Experiment 1, and we extended this effect by demonstrating that women are inclined to derogate the sexual fidelity, but not financial resources, of another woman in red, relative to white. In addition, we documented that making competition for a mate salient was not necessary for either of these effects to emerge, nor did it strengthen the effects.

Our use of white as a control color in Experiments 1 and 2 raises the question of whether red increases or white decreases perceived sexual receptivity. In many cultures, white symbolizes the opposite of sexual receptivity, namely, purity and virginity (e.g., a wedding dress, see Foster & Johnson, 2003). Using a control color devoid of these associations is important in establishing the direction of the effects observed herein. We attend to this issue in Experiment 3 by using a chromatic color for the contrast condition. In addition, in Experiment 3, we sought to further extend the results of the previous experiments by examining the degree to which female participants would intend to guard their mate from a woman wearing red.

### Experiment 3

We made several changes to the design of Experiment 3. Specifically, we changed the control color from white to green, a color that has no known associations with purity

(Adams & Osgood, 1973; Clarke & Costall, 2008; Hutchings, 1997). In addition, green is a chromatic contrast color, which allowed us to match both of the hues, red and green, on the properties of lightness and chroma. We also moved from a web-based design to using printed materials in a laboratory setting, providing more control over the stimulus presentation. To increase the generalizability of our results, we used a different target female, changed her attire from a dress to a shirt, and conducted the study in an Eastern European country. Finally, in addition to assessing perceived sexual receptivity, we assessed participants' intentions of guarding their romantic partner from the target female.

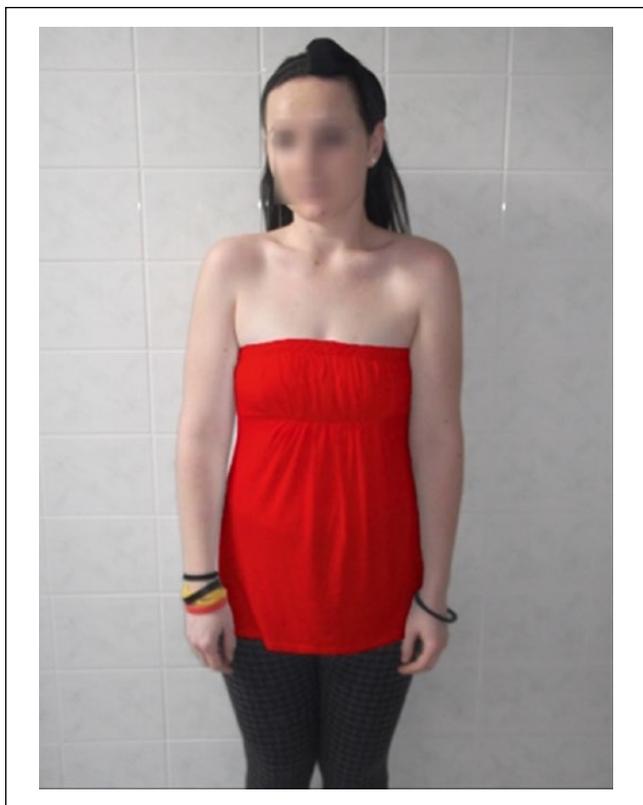
### Method

One hundred forty-three females involved in a heterosexual romantic relationship participated for partial fulfillment of a course requirement at two Slovakian universities. All participants were Caucasian, and the mean age was 20 (range = 18-29).

Participants arrived at the laboratory for a study about first impressions. They were given a folder containing a picture of a Caucasian woman in her mid-20s with brown hair, standing in front of a light gray background. Pilot data indicated that male viewers perceived the target woman as somewhat attractive ( $M = 4.2$  on a 1-10 scale). Participants were randomly assigned to view the target in either a red ( $n = 62$ ) or green ( $n = 81$ ) shirt (see Figure 3). The target's shirt color was originally white, but was manipulated via a photo filter created in Adobe Photoshop CS2; aside from the shirt color, the pictures were identical. Participants were instructed to open the folder to look at the picture; after 5 s, they were told to close the folder and were given a questionnaire to complete.

The picture was 6" long by 4" wide, printed on archival quality paper with an Epson Stylus Photo printer. A GretagMacBeth spectrophotometer was used to determine the color parameters from the spectral data (red LCh[40.6/40.4/20.1]; green LCh[40.3/41.2/146.8]).

Perceived sexual receptivity was assessed with a single face-valid item from Pazda et al. (2012; "This person is interested in sex") using a 1 (*no, not at all*) to 9 (*yes, definitely*) scale. Intended mate-guarding was assessed with two items from Vaillancourt and Sharma (2011; "How likely would you be to introduce this person to your boyfriend?" and "How likely would you be to let your boyfriend spend time alone with this person?") using a 1 (*not at all likely*) to 9 (*very likely*) scale. Responses were averaged to form a composite index ( $\alpha = .67$ ) and reverse scored, such that higher numbers indicated greater intentions to mate-guard. We also assessed perceived partner attractiveness using Roberts et al.'s (2012) seven-item measure (e.g., "How satisfied are you with your partner's physical attractiveness?"), self-perceived jealousy using a single face-valid item (i.e., "How much do you consider yourself jealous?"), and how long participants had been involved in their current relationship.



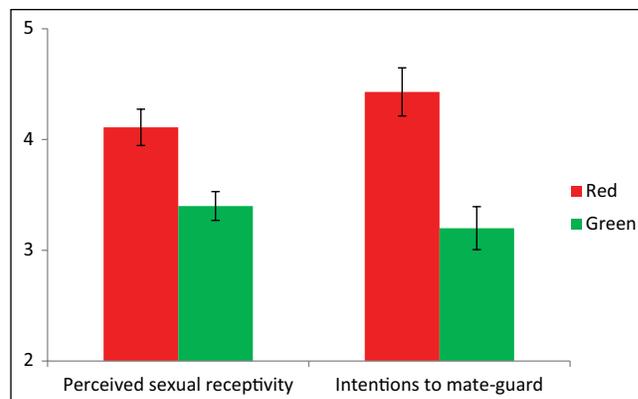
**Figure 3.** The picture used for the color manipulation in Experiment 3 (the face of the female target was intact in the experiment but is blurred here to protect privacy). Note. The shirt color was red or green.

Length of relationships ranged from 1 to 84 months, and the mean relationship length was 26 months.

### Results and Discussion

An independent-samples *t* test revealed an effect of color on perceived sexual receptivity,  $t(141) = 3.47, p = .001, d = .58, 95\% \text{ CI} = [0.31, 1.13]$ . Participants in the red condition rated the target as more sexually receptive ( $M = 4.11, SD = 1.29$ ) than participants in the green condition ( $M = 3.40, SD = 1.17$ ). An effect was also observed for intentions to mate-guard,  $t(141) = 4.22, p < .001, d = .71, 95\% \text{ CI} = [0.65, 1.81]$ . Participants in the red condition reported stronger intentions to guard their mate from the target ( $M = 4.43, SD = 1.70$ ) than participants in the green condition ( $M = 3.20, SD = 1.74$ ; see Figure 4).<sup>2</sup>

In ancillary analyses, we tested whether perceived partner attractiveness, self-perceived jealousy, or length of relationship moderated any of the results reported above. All interactive terms failed to reach significance. We also conducted each of the previous analyses including perceived partner attractiveness, self-perceived jealousy, and length of relationship as covariates. All results remained significant controlling for these variables (individually or jointly).



**Figure 4.** The effects of red (vs. green) on perceived sexual receptivity and intentions to mate-guard in Experiment 3.

Experiment 3 replicated the perceived sexual receptivity effect obtained in the previous experiments using a different target female, different attire, a different contrast color, and participants from a different location. Furthermore, we demonstrated that the red effect extends beyond perceptions of sexual receptivity and derogation to intentions to guard one's mate from another woman dressed in red.

### General Discussion

Our hypotheses were supported across three experiments. Women perceived another woman in red, relative to the same woman in white or green, as more sexually receptive (Experiments 1-3). Women also derogated a red-clad (relative to a white-clad) woman's sexual fidelity, but not her financial resources (Experiment 2). Finally, women in a committed romantic relationship were more likely to intend to guard their partner from a woman dressed in red, relative to green (Experiment 3). Our results were consistent across two target females wearing different styles of clothing, using chromatic and achromatic control colors, administering the color manipulation in the lab as well as on the Internet, and across different countries. These results provide evidence that perceiving red as a sexual signal in the mating game is not unique to men; women interpret red in a similar fashion.

The present research demonstrates red's influence on female perceptions and behavioral intentions, but it was not intended to test the origins of these effects. Thus, the degree to which societal pairings of red with female sexuality or an underlying biological predisposition (or both) is responsible for the effects remains unknown. Research on non-human primates may point toward a biological contribution for the red effects observed herein. Observations of chimpanzees have revealed that intrasexual aggression occurs when new conspecific females are introduced into a group, and this aggression is particularly likely to occur when the new females are in estrus, that is, when they have visible red-sexual swellings (Goodall, 1971). In addition, Dubuc et al.

(2009) found that red skin coloration in rhesus macaques (without any sexual swelling) was a reliable predictor of fertility, suggesting that color alone can serve as a biological sexual signal to other members of the species. Similarly, Gerald, Waite, Little, and Kraisselburd (2007) artificially reddened the faces and hindquarters of female rhesus macaques and found that other females visually attended to the reddened conspecifics more than the non-reddened conspecifics, suggesting that color may serve as a gauge of reproductive status that can be monitored by others in the group. Although research on red as a sexual signal in non-human and human primates remains rather scarce, there seems to be preliminary evidence of a cross-species parallel in how females respond to red coloration on other females.

Despite the similarity between human and non-human female primates' perception of red displays, an argument for a biological basis for the effects reported herein requires considerably more evidence. Recent work has shown that men's attraction to women in red was observed in a remote society in Burkina Faso with virtually no exposure to Western culture, hinting toward a biological explanation for the red-attraction effect (Elliot, Tracy, Pazda, & Beall, 2013). Likewise, Schwarz and Singer (2013) documented that red enhanced men's sexual attraction to a young woman of child-bearing age, but did not enhance their attraction to an older woman (perceived to be in her late 40s), suggesting that reproduction evaluation underlies the red-attraction link for men viewing women. Similar types of research findings would need to accumulate before any firm conclusions could be drawn about the origins of the effects reported here.

In the present research, red was tested against two control colors, specifically, white and green. Future research would do well to investigate whether red has similar effects when compared with other colors such as blue or yellow. Examining the color black may also be of interest. Black is typically thought of as sexy and fashionable (Pazda et al., 2014), so it, like red, may be construed as threatening by other women. Future research is also needed to test for mediators of the red effects documented herein.

In our research, we focused solely on the influence of women's red clothing on other women's impressions, but it seems likely that other red displays would lead to similar results. For example, red lipstick or blush may also make women appear more sexually receptive to other women. This may be especially likely given women's widespread use of make-up as a self-promotion strategy (Buss, 1988; Tooke & Camire, 1991). It is also possible that red accessories, such as a handbag or a scarf, would be sufficient to elicit similar results. Future research investigating these possible extensions would seem useful.

Examining the degree to which culture-specific dynamics may moderate the results reported herein would also be a promising avenue for future research. It is conceivable that women residing in countries where socio-sexuality is relatively unrestricted (e.g., England) may be more sensitive to

red as a cue to sexual interest and availability. It is also possible that countries with a high woman-to-man sex ratio, where many women are competing for relatively fewer mates, may even show stronger effects than those obtained in our samples (see Campbell, 2004). Similarly, women residing in countries where pathogenic diseases are relatively prevalent may be particularly sensitive to red, as it may indicate physical health (the absence of pathogens) in addition to sexual receptivity (Fincher & Thornhill, 2012; Re et al., 2011). However, in countries with more conservative sexual norms or where men exclusively "make the first move," the red-sexual receptivity link may be attenuated to some degree for female perceivers.

Participants in Experiment 2 derogated the sexual fidelity of a woman wearing red clothing (relative to white), but it is conceivable that other features of a red-clad woman, such as her physical attractiveness, may also be the target of derogation. Physical attractiveness is a female characteristic that men greatly value for both short-term and long-term mates, making it a seemingly good candidate for derogation (Buss, 1989; Fisher, 2004). The limited data available on women rating the attractiveness of another woman wearing or near red (Elliot & Niesta, 2008; Roberts et al., 2010) have not provided clear evidence of attractiveness derogation, although a trend toward derogation is present in the Elliot and Niesta (2008) data; additional research on this issue would be valuable. It may be helpful in such work to vary the attractiveness level of the target women, as derogation may be particularly likely when a women's attractiveness level is somewhat ambiguous (rather than clearly attractive or unattractive).

In Experiment 3, we found that women reported stronger intentions to guard their romantic partner from a woman dressed in red, relative to green. A limitation of this finding is that all of the participants in the experiment were university students. We suspect that the average length of ongoing romantic relationships for university students is relatively short (a maximum of 4 years in most cases) compared with other relationships, such as marriage. This makes it likely that the dynamics of college relationships (e.g., trust, commitment, etc.) differ from other, longer lasting relationships. Replicating the effects of Experiment 3 across more diverse types of relationships is necessary before the findings can be generalized to older, married, or more long-term couples.

Previous work has implicated the importance of clothing style when forming initial impressions of individuals (Abbey et al., 1987). The present research incorporates clothing color as a relevant feature that women attend to when forming impressions of other women. Manipulating the color of a woman's attire was sufficient to elicit derogation from participants even without explicitly framing the woman as a romantic competitor. This suggests that red may be a robust cue to female sexuality irrespective of the wearer's intentions, a reality that may have undesirable real-world implications. For example, it is possible that women wearing red clothing in a non-sexual environment, such as at the workplace, may

be evaluated negatively by other women (Abbey et al., 1987; Grabe, Bas, Pagano, & Samson, 2012). Likewise, red-clad women may be more likely to be perceived as a rival, may appear less approachable to other women, and may thus be more prone to social exclusion (Benenson, 2009; Vaillancourt & Sharma, 2011). In the present research, we examined derogation from afar and intentions to mate-guard, rather than face-to-face derogation and enacted mate-guarding. Subsequent work would do well to extend the present research accordingly, to see how generalizable our findings are to everyday mate competition behavior.

Our results suggest that women perceive and behave toward other women in red as if these other women are actively advertising sexual availability. It is important to explicitly highlight the point that not all women displaying red are necessarily signaling sexual receptivity. Our experiments do not address the underlying motivation of women dressed in red, and caution is warranted in this regard. In the same vein, it is important to highlight that our data linking the perception of red to antagonistic social behavior or intentions does not mean that red will have aversive intrasexual implications in all instances.

In closing, the present research complements existing research on male perceivers (Guéguen, 2012a; Pazda et al., 2012, 2014) by demonstrating that red clothing on women can convey sexual information to other women. On an applied level, this may have important implications for how women are perceived and treated based on something seemingly as mundane as wardrobe color. On a theoretical level, our research contributes to a growing literature documenting subtle but important effects of color on human perception and behavior.

### Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

### Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

### Notes

1. Relationship status data were not collected in Experiment 2, and participation was restricted to those in a heterosexual relationship in Experiment 3. Eight percent of participants in Experiment 1 (0% in Experiments 2 and 3) described their sexual orientation as homosexual. The percentage of participants who described their sexual orientation as bisexual ranged from 2 to 16 across the three experiments. Ancillary analyses testing whether sexual orientation interacted with the focal variables in each experiment did not yield any significant interactive effects.
2. Previous research has treated the two items that constitute our intended mate-guarding variable as separate single-item measures (Vaillancourt & Sharma, 2011). Analyzing these items individually yields significant results for each item ( $t_s > 3.39$ ,  $p_s < .001$ ).

### References

- Abbey, A. (1982). Misperceptions of friendly behavior as sexual interest: A survey of naturally occurring instances. *Psychology of Women Quarterly*, *11*, 173-194.
- Abbey, A., Cozzarelli, C., McLaughlin, K., & Harnish, R. J. (1987). The effects of clothing and dyad sex composition on perceptions of sexual intent: Do women and men evaluate these cues differently. *Journal of Applied Social Psychology*, *17*, 108-126.
- Adams, F. M., & Osgood, C. E. (1973). A cross-cultural study of the affective meanings of color. *Journal of Cross-Cultural Psychology*, *4*, 135-156.
- Barber, N. (2000). On the relationship between country sex ratios and teen pregnancy rates: A replication. *Cross Cultural Research*, *34*, 26-37.
- Beall, A. T., & Tracy, J. L. (2013). Women are more likely to wear red or pink at peak fertility. *Psychological Science*, *24*, 1837-1841.
- Benenson, J. F. (2009). Dominating versus eliminating the competition: Sex differences in human intrasexual competition. *Behavioral & Brain Sciences*, *32*, 268-269.
- Bullivant, S. B., Sellergren, S. A., Stern, K., Spencer, N. A., Jacob, S., Mennella, J. A., & McClintock, M. K. (2004). Women's sexual experience during the menstrual cycle: Identification of the sexual phase by noninvasive measurement of luteinizing hormone. *Journal of Sexual Research*, *41*, 82-93.
- Buss, D. M. (1988). The evolution of human intrasexual competition: Tactics of mate attraction. *Journal of Personality and Social Psychology*, *54*, 616-628.
- Buss, D. M. (1989). Sex differences in human mate preferences: Evolutionary hypotheses testing in 37 cultures. *Behavioral & Brain Sciences*, *12*, 1-49.
- Buss, D. M. (2011). *Evolutionary psychology: The new science of the mind* (4th ed.). New York, NY: Prentice Hall.
- Buss, D. M., & Dedden, L. A. (1990). Derogation of competitors. *Journal of Social and Personal Relationships*, *7*, 395-422.
- Buss, D. M., Shackelford, T. K., Choe, J., Buunk, B. P., & Dijkstra, P. (2000). Distress about mating rivals. *Personal Relationships*, *7*, 235-243.
- Campbell, A. (2004). Female competition: Causes, constraints, content, and contexts. *The Journal of Sex Research*, *41*, 16-26.
- Changizi, M. (2009). *The vision revolution*. Dallas, TX: BenBella.
- Clarke, T., & Costall, A. (2008). The emotional connotations of color: A qualitative investigation. *Color Research and Application*, *33*, 406-410.
- Darwin, C. (1871). *The descent of man and selection in relation to sex*. London, England: John Murray.
- Dennerstein, L., Gotts, G., Brown, J., Morse, C., Farley, T., & Pinol, A. (1994). The relationship between the menstrual cycle and female sexual interest in women with PMS complaints and volunteers. *Psychoneuroendocrinology*, *19*, 293-304.
- Dubuc, C., Brent, L., Accamando, A., Gerald, M., MacLarnon, A., Semple, S., . . . Engelhardt, A. (2009). Sexual skin color contains information about the timing of the fertile phase in free-ranging *Macaca mulatta*. *International Journal of Primatology*, *30*, 777-789.
- Durante, K. M., Li, M. P., & Haselton, M. G. (2008). Changes in women's choice of dress across the ovulatory cycle: Naturalistic and laboratory task-based evidence. *Personality and Social Psychology Bulletin*, *34*, 1451-1460.

- Eibl-Eibesfeldt, I. (1989). *Human ethology*. New York, NY: Aldine de Gruyter.
- Elliot, A. J., Greitemeyer, T., & Pazda, A. D. (2013). Women's use of red clothing as a sexual signal in intersexual interaction. *Journal of Experimental Social Psychology, 49*, 599-602.
- Elliot, A. J., & Niesta, D. (2008). Romantic red: Red enhances men's attraction to women. *Journal of Personality and Social Psychology, 95*, 1150-1164.
- Elliot, A. J., & Pazda, A. D. (2012). Dressed for sex: Red as a female sexual signal in humans. *PLoS ONE, 7*, e34607.
- Elliot, A. J., Tracy, J., Pazda, A. D., & Beall, A. (2013). Red enhances women's attractiveness to men: First evidence suggesting universality. *Journal of Experimental Social Psychology, 49*, 165-168.
- Fincher, C. L., & Thornhill, R. (2012). Parasite-stress promotes in-group assortative sociality: The cases of strong family ties and heightened religiosity. *Behavioral & Brain Sciences, 35*, 61-79.
- Fink, B., Klappauf, D., Brewer, G., & Shackelford, T. K. (2014). Female physical characteristics and intra-sexual competition in women. *Personality and Individual Differences, 58*, 138-141.
- Fisher, M. L. (2004). Female intrasexual competition decreases female facial attractiveness. *Proceedings of the Royal Society, Series B: Biological Sciences, 271*, S283-S285.
- Fisher, M. L., Cox, A., & Gordon, F. (2009). Self-promotion versus competitor derogation: The influence of sex and romantic relationship status on intrasexual competition strategy selection. *Journal of Evolutionary Psychology, 7*, 287-308.
- Foster, H. B., & Johnson, D. C. (Eds.). (2003). *Wedding dress across cultures*. New York, NY: Berg.
- Gerald, M. S., Waite, C., Little, A. C., & Kraiselburd, E. (2007). Females pay attention to female secondary sexual color: An experimental study in *Macaca mulatta*. *International Journal of Primatology, 28*, 1-7.
- Goodall, J. (1971). *In the shadow of man*. Boston, MA: Houghton Mifflin.
- Grabe, M. E., Bas, O., Pagano, L. A., & Samson, L. (2012). The architecture of female competition: Derogation of a sexualized female news anchor. *Journal of Evolutionary Psychology, 10*, 107-133.
- Guéguen, N. (2012a). Color and women attractiveness: When red clothed women are perceived to have more intense sexual intent. *The Journal of Social Psychology, 152*, 261-265.
- Guéguen, N. (2012b). Color and women hitchhikers' attractiveness: Gentlemen drivers prefer red. *Color Research and Application, 37*, 76-78.
- Guéguen, N. (2012c). Makeup and menstrual cycle: Near ovulation, women use more cosmetics. *Psychological Record, 62*, 1-8.
- Guéguen, N., & Jacob, C. (2013). Color and cyber-attractiveness: Red enhances men's attraction to women's internet personal ads. *Color Research and Application, 38*, 309-312.
- Guéguen, N., & Jacob, C. (2014). Clothing color and tipping: Gentlemen patrons give more tips to waitresses with red clothes. *Journal of Hospitality & Tourism Research, 38*, 275-280.
- Haselton, M. G. (2003). The sexual overperception bias: Evidence of systematic bias in men from survey of naturally occurring events. *Journal of Research in Personality, 37*, 34-47.
- Haselton, M. G., & Gangestad, S. W. (2006). Conditional expression of women's desires and men's mate guarding across the ovulatory cycle. *Hormones and Behavior, 49*, 509-518.
- Haselton, M. G., Mortezaie, M., Pillsworth, E. G., Bleske-Rechek, A., & Frederick, D. A. (2007). Ovulatory shifts in human female ornamentation: Near ovulation, women dress to impress. *Hormones and Behavior, 51*, 40-45.
- Hutchings, J. (1997). Folklore and symbolism of green. *Folklore, 108*, 55-64.
- Katchadourian, H. A. (1984). *Fundamentals of human sexuality* (4th ed.). New York, NY: Holt, Rinehart and Winston.
- Niesta Kayser, D., Elliot, A. J., & Feltman, R. (2010). Red and romantic behavior in men viewing women. *European Journal of Social Psychology, 40*, 901-908.
- Oberzaucher, E., Katina, S., Schmehl, S., Holzleitner, I., Meublantar, I., & Grammer, K. (2012). The myth of hidden ovulation: Shape and texture changes in the face during the menstrual cycle. *Journal of Evolutionary Psychology, 10*, 163-175.
- Pazda, A. D., Elliot, A. J., & Greitemeyer, T. (2012). Sexy red: Perceived sexual receptivity mediates the red-attraction relation in men viewing women. *Journal of Experimental Social Psychology, 48*, 787-790.
- Pazda, A. D., Elliot, A. J., & Greitemeyer, T. (2014). Perceived sexual receptivity and fashionableness: Separate paths linking red and black to perceived attractiveness. *Color Research and Application, 39*, 208-212.
- Prokop, P., & Hromada, M. (2013). Women use red in order to attract mates. *Ethology, 119*, 605-613.
- Re, D. E., Whitehead, R. D., Xiao, D., & Perrett, D. I. (2011). Oxygenated-blood colour change thresholds for perceived facial redness, health, and attractiveness. *PLoS ONE, 6*, e17859.
- Roberts, S. C., Klapilová, K., Little, A. C., Burriss, R. P., Jones, B. C., DeBruine, L. M., . . . Havlíček, J. (2012). Relationship satisfaction and outcome in women who meet their partner while using oral contraception. *Proceedings of the Royal Society, Series B: Biological Sciences, 279*, 1430-1436.
- Roberts, S. C., Owen, R. C., & Havlicek, J. (2010). Distinguishing between perceiver and wearer effects in clothing color-associated attributions. *Evolutionary Psychology, 8*, 350-364.
- Samson, N., Fink, B., & Matts, P. J. (2011). Does a woman's skin color indicate her fertility level? *Swiss Journal of Psychology, 70*, 199-202.
- Schmitt, D. P., & Buss, D. M. (1996). Strategic self-promotion and competitor derogation: Sex and context effects on the perceived effectiveness of mate attraction tactics. *Journal of Personality and Social Psychology, 70*, 1185-1204.
- Schwarz, S., & Singer, M. (2013). Romantic red revisited: Red enhances men's attraction to young, but not menopausal women. *Journal of Experimental Social Psychology, 49*, 161-164.
- Stephen, I. D., & McKeegan, A. M. (2010). Lip colour affects perceived sex typicality and attractiveness of human faces. *Perception, 39*, 1104-1110.
- Tooke, W., & Camire, L. (1991). Patterns of deception in intersexual and intrasexual mating strategies. *Ethology and Sociobiology, 12*, 345-364.
- Tracy, J. L., & Beall, A. T. (2014). The impact of weather on women's tendency to wear red pink when at high risk for conception. *PLoS ONE, 9*, e88852.
- Trivers, R. (1972). Parental investment and sexual selection. In B. Campbell (Ed.), *Sexual selection and the descent of man: 1871-1971* (pp. 136-179). Chicago, IL: Aldine Transaction.

- Vaillancourt, T. (2005). Indirect aggression among humans: Social construct or evolutionary adaptation? In R. Tremblay, W. Hartup, & J. Archer (Eds.), *Developmental origins of aggression* (pp. 158-177). New York, NY: Guilford Press.
- Vaillancourt, T., & Sharma, A. (2011). Intolerance of sexy peers: Intrasexual competition among women. *Aggressive Behavior*, *37*, 569-577.
- Wallen, K., & Rupp, H. A. (2010). Women's interest in visual sexual stimuli varies with menstrual cycle phase at first exposure and predicts later interest. *Hormones and Behavior*, *57*, 263-268.
- Walters, S., & Crawford, C. B. (1994). The importance of mate attraction for intrasexual competition in men and women. *Ethology and Sociobiology*, *15*, 5-30.