



Women's red clothing can increase mate-guarding from their male partner



Pavol Prokop^{a,b,*}, Adam D. Pazda^c

^a Department of Biology, Faculty of Education, Trnava University, Trnava, Slovakia

^b Institute of Zoology, Slovak Academy of Sciences, Dúbravská cesta 9, 845 06 Bratislava, Slovakia

^c Department of Psychology, University of South Carolina, Aiken, United States

ARTICLE INFO

Article history:

Received 27 January 2016

Received in revised form 2 April 2016

Accepted 4 April 2016

Available online xxxx

Keywords:

Color

Mate guarding

Red

Sex

ABSTRACT

Mate guarding is a common strategy that functions to prevent individuals from engaging in extra-pair copulations. For women, wearing red clothing can be perceived by men as a signal of sexual receptivity. Thus, men may guard their mate more strongly when she is wearing red, relative to other colors. We tested this hypothesis by examining the intensity of anticipated mate-guarding behaviors in conditions where women were imagined (by their partner and themselves) to wear red or black clothing in a repeated-measures design. Results showed stronger anticipated mate-guarding behaviors from men when they imagined their partner in red, relative to black. Women were unable to predict the intensity of mate-guarding from their partner with respect to color condition. Partner satisfaction did not moderate these findings in either sex.

© 2016 Elsevier Ltd. All rights reserved.

1. Introduction

Female promiscuity, a practice of having frequent sex with more than one partner, is common in a range of animals, including humans (Birkhead & Møller, 1998; Greiling & Buss, 2000). In contemporary Western societies, roughly 14–50% of young women have reported cases of their sexual infidelities (Greiling & Buss, 2000; Prokop & Fedor, 2013; Simmons, Firman, Rhodes, & Peters, 2004). This may significantly impair male reproductive success, which would provide men with motivation to guard their mates from potential extra-pair relationships (Shackelford, Goetz, Guta, & Schmitt, 2006).

Female extra-pair mating can result in male investment to offspring that are not genetically his own (Shackelford et al., 2006). Therefore, sexual selection should favor male strategies that prevent female infidelity (Leivers, Rhodes, & Simmons, 2014). Mate guarding is a common strategy that functions to prevent women from engaging in extra-pair copulations (Buss & Shackelford, 1997), causing potential rivals to choose other prospective targets (Schmitt & Buss, 2001). Men may respond to the risk of infidelity, for example, by staying in closer proximity to their partner (Buss, 1988), increasing copulation frequency (Shackelford et al., 2006), or by aggressing toward rivals (Roma et al., 2012). However, investment in mate guarding is costly in terms of time, energy, and increased physiological stress (Girard-Buttoz et al.,

2014a; Komdeur, 2001). Therefore, males should invest in mate guarding strategies particularly when the reproductive benefits outweigh energy expenditure or physiological costs (Girard-Buttoz et al., 2014b; Leivers et al., 2014). Indeed, mate guarding in humans is stronger when women have greater reproductive value, particularly when the woman is more attractive and young (Buss & Shackelford, 1997; Kaighobadi & Shackelford, 2008; Pham et al., 2014) and/or she is in the fertile phase of her menstrual cycle (Haselton & Gildersleeve, 2011).

Human females use various strategies to increase their own attractiveness to men, and women's attire plays a role in male attraction (Grammer, Renninger, & Fischer, 2004; Haselton, Mortezaie, Pillsworth, Bleske-Rechek, & Frederick, 2007). Women prefer red clothing when the likelihood of meeting a potential mate is high (Elliot, Greitemeyer, & Pazda, 2013; Prokop & Hromada, 2013) and when the likelihood of conception is highest (Eisenbruch, Simmons, & Roney, 2015; Tracy & Beall, 2014). Red clothing significantly increases women's sexual attractiveness to men, both under laboratory (Elliot & Niesta, 2008; Young, 2015) and real life conditions (Guéguen, 2012), presumably because men interpret red as a signal of sexual interest (Pazda, Elliot, & Greitemeyer, 2012). Therefore, it is reasonable to posit that men should increase mate guarding behaviors when their female partner is wearing red clothing because red makes women more attractive to potential romantic rivals.

In the present study we investigated the influence of red clothing on men's anticipated mate guarding behavior. We hypothesized that when a man imagines his female partner wearing red clothing, he will anticipate enacting more vigorous mate-guarding behavior, relative to when his partner is wearing black clothing. Furthermore, we tested whether

* Corresponding author at: Department of Biology, Faculty of Education, Trnava University, Priemysel'ná 4, 918 43 Trnava, Slovakia.
E-mail address: pavol.prokop@savba.sk (P. Prokop).

satisfaction with one's partner would moderate the effect of red clothing because low partner satisfaction may indicate low perceived partner value, which may inhibit mate-guarding (Buss & Shackelford, 1997; Klusmann, 2002).

2. Method

2.1. Participants

The research was carried out during the Winter Semester of 2014 (September – December) at a university in Slovakia. Roughly 400 freshman students were asked to participate in the experiment for extra course credit. Participants were asked to recruit their romantic partner to participate in the study. Those who were not involved in romantic relationships were excluded, but were given the option to participate in a different study. A total of 223 heterosexual pairs comprised the final sample. The mean age of males was 22.9 (SD = 4.2), and the mean age of females was 20.2 (SD = 2.41). All participants were Caucasian.

2.2. Measures

2.2.1. Mate-guarding scenario and measurement

Participants read a scenario in which the woman is going out with some friends without her male partner, along with a picture of the supposed clothing that she will be wearing. The clothing item displayed was randomly assigned to be either a red or black dress. Then participants answered seven modified items obtained from the Mate Retention Inventory (Buss, 1988). Male participants were asked to indicate their likelihood of engaging in the listed behaviors under the hypothetical scenario by using a Likert scale anchored from 1 (not at all likely) to 7 (very likely). Female participants were asked to indicate the likelihood that their partner would engage in the behaviors listed under the hypothetical scenario using the same Likert scale. After completing their ratings, participants were shown the other colored dress (red or black, depending on which was randomly chosen to be seen first), and completed the same mate-guarding measure. Cronbach's α for combined data from both black and red treatments was 0.86 for males and 0.87 for females. Summed scores of the mate guarding responses were used in the statistical analyses. Details regarding items and instructions are in the Appendix.

2.2.2. Clothing color manipulation

We took a photograph of a white knee-length dress and applied a color mask using Adobe Photoshop CS2. Separate red and black versions of the dress were created, ensuring that the pictures were identical aside from color (see Fig. 1).



Fig. 1. Red and black versions of the dress used in the scenarios.

2.2.3. Partner satisfaction

The four-item Partner Satisfaction Scale (PSS; Pham, Shackelford, & Sela, 2013) was administered to investigate participants' partner satisfaction. This scale consists of four questions about their relationship satisfaction, answered on a Likert-type scale ranging from 1 (not at all) to 7 (extremely). Summed scores of the PSS were used in the statistical analyses. Cronbach's α for males and females was 0.82 and 0.79, respectively.

2.3. Procedure

The research was carried out online. Prior to completing the experiment, each couple received an ID code to establish their dyadic identity, but participants were instructed to complete the experiment independently. Participants were initially asked demographic questions (age, sex, relationship length), then responded to the mate guarding scenarios and partner satisfaction scale.

3. Results

Due to the nested structure of our data, we used hierarchical linear modeling (HLM; Bryk & Raudenbush, 1992) to test our hypothesis. Self-reported mate-guarding for each color condition (Level 1) was nested within participants (Level 2), and participants were nested within dyads (Level 3).

We first created a model that tested the effect of color condition (dummy coded; 1 = red, 0 = black) on mate-guarding with no predictors at Level 2 or Level 3 (see model below).

Level 1 model:

$$Y = \pi_0 + \pi_1(\text{red}) + e$$

Level 2 model:

$$\pi_0 = \beta_{00} + r_1$$

$$\pi_1 = \beta_{10}$$

Level 3 model:

$$\beta_{00} = \gamma_{000} + \mu_{10}$$

$$\beta_{10} = \gamma_{100}$$

The intercept of mate-guarding (i.e., the reported mate-guarding for the black condition, averaged across all participants) was 17.97. The effect of red was significant, $B = .55$, $t(890) = 4.34$, $p < .001$, indicating that participants reported higher mate-guarding in the red condition, relative to the black condition.

Next we examined whether individual or dyadic variables would have main or interactive effects with color condition on mate-guarding. In this model, we added sex (dummy coded; 1 = male, 0 = female), and partner satisfaction as Level 2 predictors; relationship length (in months) was included as a Level 3 predictor. All continuous variables were grand-mean centered, and intercepts at each level were allowed to vary randomly (see model below).

Level 1 model:

$$Y = \pi_0 + \pi_1(\text{red}) + e.$$

Level 2 model:

$$\pi_0 = \beta_{00} + \beta_{01}(\text{sex}) + \beta_{02}(\text{partner satisfaction}) + r_0$$

$$\pi_1 = \beta_{10} + \beta_{11}(\text{sex}) + \beta_{12}(\text{partner satisfaction})$$

Table 1
HLM analysis predicting mate-guarding.

Predictor	B	SE	p
Intercept	18.002	0.629	0.001
Red	0.292	0.195	0.135
Male	−0.066	0.476	0.889
Partner satisfaction	−0.102	0.121	0.399
Relationship length	0.015	0.029	0.608
(Red) by (male)	0.481	0.229	0.036
(Red) by (partner satisfaction)	0.020	0.030	0.493
(Red) by (relationship length)	0.003	0.009	0.697
(Red) by (male) by (relationship length)	−0.004	0.009	0.705
(Red) by (partner satisfaction) by (relationship length)	0.002	0.002	0.300

Note. All B coefficients are unstandardized estimates. Interaction terms are designated using parentheses to surround the names of the individual variables with the word “by” separating the two variables.

Level 3 model:

$$\begin{aligned}\beta_{00} &= \gamma_{000} + \gamma_{001}(\text{relationship length}) + \mu_{00} \\ \beta_{01} &= \gamma_{010} \\ \beta_{02} &= \gamma_{020} \\ \beta_{10} &= \gamma_{100} + \gamma_{101}(\text{relationship length}) \\ \beta_{11} &= \gamma_{110} + \gamma_{111}(\text{relationship length}) \\ \beta_{12} &= \gamma_{120} + \gamma_{121}(\text{relationship length})\end{aligned}$$

A significant cross-level interaction emerged between participant sex and color condition, $B = .48$, $t(882) = 2.10$, $p = .036$ (see Table 1). This indicates that men's reported mate-guarding differed from women's prediction of their partner's mate-guarding as a function of color condition (see Fig. 2). Simple slopes analyses indicated that men reported more intense mate-guarding when they imagined their partner wearing red clothing, relative to black ($B = .77$, $t = 4.97$, $p < .001$). However, women did not anticipate that their partner would intensify his mate-guarding behaviors in the red condition ($B = .29$, $t = 1.45$, $p = .15$).

4. Discussion

This study provides evidence that a woman's dress color may influence her male partner's inclination to engage in mate guarding. Specifically, men reported increasing their mate guarding efforts when they imagined their female partner wearing a red (relative to black) dress, and women predicted no difference in their partner's mate-guarding across colors. These outcomes were not influenced by partner satisfaction or relationship length.

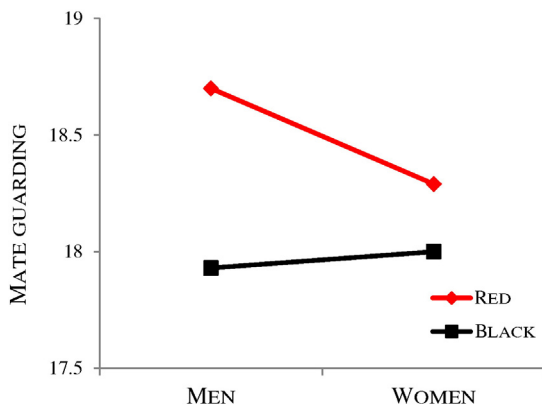


Fig. 2. The interaction between color condition and participant sex on mate guarding.

These results support the idea that men's mate guarding relates to women's reproductive value (Haselton & Gildersleeve, 2011; Kaighobadi & Shackelford, 2008; Pham et al., 2014; Shackelford & Buss, 1997), as women prefer red clothing when they are fertile (Eisenbruch et al., 2015) and have an opportunity to meet attractive men (Kayser, Agthe, & Maner, 2016; Elliot et al., 2013; Prokop & Hromada, 2013). Moreover, red increases women's sexual attractiveness, which can lead to approach oriented behavior from men at the time when the likelihood of conception is highest. Thus, guarding one's red clad female partner may be a reasonable strategy to increase paternity certainty.

Women were unable to predict the effect of wearing red on their partner's propensity to enact mate-guarding behaviors. This raises the question of whether men are somehow more sensitive to red's sexual symbolism than women are. This seems unlikely because previous research has shown that women perceived other women dressed in red as promiscuous, and they reported greater intentions of keeping their male partner at a distance from women in red clothing (Pazda, Prokop & Elliot, 2014). This suggests that women indeed interpret red as a sexual signal, but it remains unknown why the color manipulation in the present study was interpreted differently across sexes. One possibility is that when the sexual intentions of a third party are unknown (women rating other women), red acts as a signal of sexual receptivity. However, when the sexual intentions of oneself are known (and low), red may be perceived as a more benign color. Another possibility is that only highly attractive women who draw attention from rivals are aware that wearing red may stimulate mate guarding from their male partners. Future research providing a more detailed investigation of female attractiveness would be enlightening.

The effect of red clothing on men's reported mate-guarding observed herein was statistically significant, but the effect size was small. We believe this could be a result of the overall attractiveness of the color black, which was used as our comparison color. For example, Roberts, Owen, and Havlíček (2010) found that both red and black were associated with higher attractiveness judgments and had approximately equivalent effects on perceived attractiveness for men rating women. Additionally, Pazda, Elliot, and Greitemeyer (2014) showed that red and black increased men's perceptions of women's attractiveness, relative to white. These findings indicate that the use of black as a comparison color produces a conservative test of the red effect. Future research utilizing other comparison colors that do not increase attractiveness would potentially yield larger effects.

In conclusion, men in committed relationships are inclined to inhibit their partner's accessibility to rivals when their partner is dressed in red clothing. This provides evidence that motivation to guard one's mate does not only vary between individuals due to their personal characteristics (e.g., attractiveness, jealousy), but also varies within individuals depending on situational circumstances. These findings highlight the notion that color is much more than an esthetic stimulus; it can have a broad range of effects on human psychological functioning, particularly in mating-relevant situations.

Acknowledgement

We thank Nina Sýkorová for help with data collection.

Appendix A. Appendix

A.1. Scenario

For males:

Imagine that your girlfriend is going out with some friends tonight, but you will not be joining her. Also imagine that she will be wearing the dress shown in the photograph. Please indicate the likelihood that

you would engage in the following behaviors throughout the night.

For females:

Imagine that you are going out with some friends tonight, but your boyfriend will not be joining you. Also imagine that you will be wearing the dress shown in the photograph. Please indicate the likelihood that your boyfriend would engage in the following behaviors throughout the night.

A.2. Mate-guarding items (all slightly modified from Buss, 1988)

For males:

You call her at unexpected times to see who she is with.
 You call her to make sure she is where she said she will be.
 You have your friends check up on her.
 You drop by unexpectedly to see what she is doing.
 You question her about what she did when she was out.
 You will not let her go out without you.
 You insist that she stays home with you rather than go out.

For females:

Your boyfriend will call you at unexpected times to see who you are with.

Your boyfriend will call you to make sure you are where you said you will be.

Your boyfriend will ask his friends check up on you.

Your boyfriend will drop by unexpectedly to see what you are doing.

Your boyfriend will ask you about what you did when you were out.

Your boyfriend will ask you not to go out without him.

Your boyfriend will ask you to stay at home with him rather than go out.

These items were answered on a scale from 1 (not at all likely) to 7 (very likely).

References

- Birkhead, T. R., & Møller, A. P. (Eds.). (1998). *Sperm competition and sexual selection*. London, UK: Academic Press.
- Bryk, A. S., & Raudenbush, S. W. (1992). *Hierarchical linear models in social and behavioral research: applications and data analysis methods* (1st ed.). Newbury Park, CA: Sage Publications.
- Buss, D. M. (1988). From vigilance to violence: Tactics of mate retention in American undergraduates. *Ethology & Sociobiology*, 9, 291–317.
- Buss, D. M., & Shackelford, T. K. (1997). From vigilance to violence: Mate retention tactics in married couples. *Journal of Personality and Social Psychology*, 72, 346–361.
- Eisenbruch, A. B., Simmons, Z. L., & Roney, J. R. (2015). Lady in red: Hormonal predictors of women's clothing choices. *Psychological Science*. <http://dx.doi.org/10.1177/0956797615586403>.
- Elliot, A. J., & Niesta, D. (2008). Romantic red: red enhances men's attraction to women. *Journal of Experimental Social Psychology*, 95, 1150–1164.
- 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.
- Girard-Buttoz, C., Heistermann, M., Rahmi, E., Agil, M., Fauzan, P. A., & Engelhardt, A. (2014a). Costs of mate-guarding in wild male long-tailed macaques (*Macaca fascicularis*): physiological stress and aggression. *Hormones and Behavior*, 66, 637–648.
- Girard-Buttoz, C., Heistermann, M., Rahmi, E., Agil, M., Fauzan, P. A., & Engelhardt, A. (2014b). Costs of and investment in mate-guarding in wild long-tailed macaques (*Macaca fascicularis*): Influences of female characteristics and male-female social bonds. *International Journal of Primatology*, 35, 701–724.
- Grammer, K., Renninger, L., & Fischer, B. (2004). Disco clothing, female sexual motivation, and relationship status: Is she dressed to impress? *Journal of Sex Research*, 41, 66–74.
- Greiling, H., & Buss, D. M. (2000). Women's sexual strategies: The hidden dimension of extra-pair mating. *Personality and Individual Differences*, 28, 929–963.
- Guéguen, N. (2012). Color and women hitchhikers' attractiveness: Gentlemen drivers prefer red. *Color Research and Application*, 37, 76–78.
- Haselton, M. G., & Gildersleeve, K. (2011). Can men detect ovulation? *Current Directions in Psychological Science*, 20, 87–92.
- 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.
- Kaighobadi, F., & Shackelford, T. K. (2008). Female attractiveness mediates the relationship between in-pair copulation frequency and men's mate retention behaviors. *Personality and Individual Differences*, 45, 293–295.
- Kayser, D. N., Agthe, M., & Maner, J. K. (2016). Strategic sexual signals: Women's display versus avoidance of the color red depends on the attractiveness of an anticipated interaction partner. *PLoS One*. <http://dx.doi.org/10.1371/journal.pone.0148501>.
- Klumsann, D. (2002). Sexual motivation and the duration of partnership. *Archives of Sexual Behavior*, 31, 275–287.
- Komdeur, J. (2001). Mate guarding in the Seychelles warbler is energetically costly and adjusted to paternity risk. *Proceedings of the Royal Society of London Series B*, 268, 2103–2111.
- Leivers, S., Rhodes, G., & Simmons, L. W. (2014). Sperm competition in humans: Mate guarding behavior negatively correlates with ejaculate quality. *PLoS One*, 9, e108099.
- 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.
- Pazda, A. D., Prokop, P., & Elliot, A. J. (2014). 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*, 40, 1260–1269.
- 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.
- Pham, M. N., Shackelford, T. K., & Sela, Y. (2013). Women's oral sex behaviors and risk of partner infidelity. *Personality and Individual Differences*, 55, 446–449.
- Pham, M. N., Shackelford, T. K., Holden, C. J., Zeigler-Hill, V., Hummel, A., & Memering, S. (2014). Partner attractiveness moderates the relationship between number of sexual rivals and in-pair copulation frequency in humans (*Homo sapiens*). *Journal of Comparative Psychology*, 128, 328–331.
- Prokop, P., & Fedor, P. (2013). Associations between body morphology, mating success and mate preferences among Slovak males and females. *Anthropologischer Anzeiger*, 70, 121–135.
- Prokop, P., & Hromada, M. (2013). Women use red in order to attract mates. *Ethology*, 119, 605–613.
- Roberts, S. C., Owen, R. C., & Havlíček, J. (2010). Distinguishing between perceiver and wearer effects in clothing color-associated attributions. *Evolutionary Psychology*, 8, 350–364.
- Roma, P., Spacca, A., Pompili, M., Lester, D., Tatarelli, R., Girardi, P., & Ferracuti, S. (2012). The epidemiology of homicide-suicide in Italy: A newspaper study from 1985 to 2008. *Forensic Science International*, 214, E1–E5.
- Schmitt, D. P., & Buss, D. M. (2001). Human mate poaching: Tactics and temptations for infiltrating existing relationships. *Journal of Personality and Social Psychology*, 80, 894–917.
- Shackelford, T. K., & Buss, D. M. (1997). Cues to infidelity. *Personality and Social Psychology Bulletin*, 23, 1034–1045.
- Shackelford, T. K., Goetz, A. T., Guta, F. E., & Schmitt, D. P. (2006). Mate guarding and frequent in-pair copulation in humans: Concurrent or compensatory anti-cuckoldry tactics? *Human Nature*, 17, 239–252.
- Simmons, L. W., Firman, R. C., Rhodes, G., & Peters, M. (2004). Human sperm competition: Testis size, sperm production and rates of extrapair copulations. *Animal Behaviour*, 68, 297–302.
- Tracy, J. L., & Beall, A. T. (2014). The impact of weather on women's tendency to wear red or pink when at high risk for conception. *PLoS One*, 9, e88852.
- Young, S. G. (2015). The effect of red on male perceptions of female attractiveness: Moderation by baseline attractiveness of female faces. *European Journal of Social Psychology*, 45, 146–151.