



## FlashReport

# Sexy red: Perceived sexual receptivity mediates the red-attraction relation in men viewing woman<sup>☆</sup>

Adam D. Pazda<sup>a,\*</sup>, Andrew J. Elliot<sup>a</sup>, Tobias Greitemeyer<sup>b</sup>

<sup>a</sup> University of Rochester, USA

<sup>b</sup> University of Innsbruck, Austria

## ARTICLE INFO

## Article history:

Received 19 October 2011

Revised 13 December 2011

Available online 22 December 2011

## Keywords:

Color

Red

Attractiveness

Attraction

Desire

## ABSTRACT

In many non-human primate species, female red displays are a signal of sexual receptivity and this signal attracts male conspecifics. In the present research, we proposed and tested a human analog whereby perceived sexual receptivity mediates the relation between red and sexual attraction in men viewing women. Two experiments were conducted, each of which provided support for the hypothesized mediational model. Experiment 1 documented the mediational role of perceived sexual receptivity using the experimental-causal-chain approach, and Experiment 2 did so using the measurement-of-mediation approach. Alternative mediator variable candidates were ruled out, and participants showed no evidence of awareness of the red effect. These findings document red as a subtle, but surprisingly powerful environmental stimulus that can serve parallel functions in the mating game for human and non-human primates.

© 2011 Elsevier Inc. All rights reserved.

## Introduction

Female red displays play an integral role in the mating process of many non-human primate species (e.g., baboons, chimpanzees). Females display red on their face, chest, or genitalia as a signal of sexual receptivity (Dixon, 1983; Setchell & Wickings, 2004), and male conspecifics respond with increased gaze, self-stimulation, and copulation attempts (Bielert, Girolami, & Jowell, 1989; Waitt, Gerald, Little, & Krasieburd, 2006). Elliot and Niesta (2008) recently demonstrated that red displays are also important in the mating game for human males and females. They observed that men find women wearing red to be more attractive and sexually desirable; they did not, however, investigate the psychological process responsible for this effect.

Herein we propose and test the hypothesis that perceived sexual receptivity mediates the link between red and sexual attraction in men viewing women. Data supporting this hypothesis would not only provide a more thorough understanding of the amorous influence of red in humans, but would establish a more precise and detailed cross-species parallel regarding the signal function of red in mating contexts.

The first step in our proposed mediational model is that men view red on a woman as a signal of sexual receptivity. The societal pairing of red and female sexual receptivity has a long history. Red was used as early as 10,000 B.C.E. in lipstick and rouge to mimic the red blush of sexual interest and excitement (Low, 1979); red has been used in mythology, folklore, and literature throughout the ages to represent

sexual promiscuity and passion (Hutchings, 2004; Jobs, 1962); and red has long signaled sexual availability in red-light districts. Thus, men may associate red and female sexual receptivity due to societal conditioning.

This red-receptivity link may also be rooted in biology. Women's skin tone lightens during ovulation, their general blood flow is enhanced, and they are more easily sexually aroused (Bullivant et al., 2004; Lynn, McCord, & Halliwell, 2007; Van den Bergh & Frost, 1986). As such, the aforementioned red blush of sexual interest and excitement may be more prevalent and visible midcycle, meaning women, like other female primates, may display red more prominently when most fertile. If so, it is likely that men, like other male primates, are biologically predisposed to interpret red on a female conspecific as a signal of sexual readiness.

Our proposal, that red conveys the meaning of sexual receptivity for men viewing women, may be derived from societal conditioning or biological considerations alone, but we suspect that both are implicated in the red-receptivity link. Specifically, we contend that the societal pairing of red and female sexual receptivity is not random, but emerged from a biologically-based predisposition to interpret female red as a sexual signal. Indeed, the societal use of red may not only reinforce the biological predisposition, but may extend it beyond the tether of natural bodily processes. Accordingly, red may not only mean sexual readiness when viewed on a woman's body, but also when viewed on objects in close proximity to her body. In the present research, we predict that men viewing a woman wearing a red shirt will perceive her to be more sexually receptive.

The second step in our proposed mediational model is that men view sexually receptive women as particularly attractive and desirable. Men may prefer sexually receptive women because pursuing

<sup>☆</sup> Part of this research was supported by grant GR 1882/12-1 from the German Research Foundation to Tobias Greitemeyer.

\* Corresponding author.

E-mail address: [apazda@gmail.com](mailto:apazda@gmail.com) (A.D. Pazda).

such women facilitates sexual conquests; a large number of sexual conquests is congruent with gender-specific standards and scripts and, therefore, is rewarded with admiration and social status (Oliver & Hyde, 1993). Men may also prefer sexually receptive women because pursuing such women increases their chances of reproductive success via mating with many sexual partners in efficient fashion (i.e., low time and effort costs; Schmitt & Buss, 1996). The available data support a receptivity–attraction link, as men rate women exhibiting receptivity cues (e.g., suggestive postures, provocative dancing) as more attractive (Clark, 2008; Schmitt, Couden, & Baker, 2001), and are more inclined to make advances toward such women (Hendrie, Mannion, & Godfrey, 2009). This effect is not limited to humans, but is present in many other mammalian species, including primates (Andersson, 1994; Beach, 1976).

In the present research, we not only predicted a link between men's perceptions of women's sexual receptivity and men's sexual attraction, we also predicted that perceived sexual receptivity would be the psychological mechanism that explains the direct influence of red on sexual attraction. Furthermore, given the subtlety of red as a stimulus cue, we anticipated that the effect of red would take place without participants' conscious awareness. Finally, and importantly, we tested two other candidate mediators, kindness and intelligence, characteristics that men across cultures value in women (Buss, 1989). If, as hypothesized, red carries a specific sexual meaning, rather than a positive meaning in general, sexual receptivity alone would be confirmed as a mediator. We conducted two experiments to test our predictions using two different, complementary, approaches to mediation.

### Experiment 1a

Experiment 1 tested whether perceived sexual receptivity mediates the influence of red on perceived attractiveness using the experimental-causal-chain approach (Spencer, Zanna, & Fong, 2005). Experiment 1a examined the first link in the hypothesized causal chain. White was used as an unobtrusive, achromatic contrast to red.

#### Method

Twenty-five males (ages = 22–40,  $M = 28.7$ ) participated for modest monetary compensation. Ethnicity was: 9 Caucasian, 1 African American, 11 Asian, and 4 “other.” In this and all subsequent experiments, participation was restricted to heterosexuals/bisexuals without a color deficiency.

Participants followed a web link through Mechanical Turk to access the experiment. A welcome screen stated that the experiment was about first impressions and would involve viewing a picture of a person for five seconds and completing a brief questionnaire. The picture was of a moderately attractive young woman with brown hair, wearing either a red ( $n = 11$ ) or white ( $n = 14$ ) shirt. Shirt color was manipulated using Adobe Photoshop; the picture was 350 pixels  $\times$  450 pixels. Participants viewed the picture, then completed the questionnaire.

Perceived sexual receptivity was assessed with four face-valid items (e.g., “She is interested in sex”;  $\alpha = .85$ ). For this and all subsequent measures, participants responded using 1 (not at all/strongly disagree) to 9 (extremely/strongly agree) scales. Participants were also asked to guess the purpose of the experiment.

#### Results

An independent-samples  $t$ -test revealed an effect of color on perceived sexual receptivity,  $t(23) = 2.11$ ,  $p < .05$ ,  $d = 0.88$ . Participants in the red condition ( $M = 5.50$ ,  $SD = 1.04$ ) rated the woman as more receptive than participants in the white condition ( $M = 4.30$ ,  $SD = 1.63$ ;

Fig. 1a). No participant mentioned color when guessing the purpose of the experiment.

### Experiment 1b

Experiment 1b examined the second link in the hypothesized causal chain.

#### Method

Twenty-two males (ages 19–40,  $M = 29.2$ ) participated for modest monetary compensation. Ethnicity was: 5 Caucasian and 17 Asian.

Participants followed a web link through Mechanical Turk to access the experiment. A welcome screen stated that the experiment was about first impressions and would involve viewing a picture of a person for five seconds, reading a brief scenario about the person, and then completing a brief questionnaire. Participants then read either the high or low (parentheses) sexual receptivity scenario:

*Imagine the woman in the picture is at a bar for the evening. She is acting flirtatiously (reserved), and her body language is sexy (stern) and seductive (rigid), seeming to indicate that she is (not) interested in the possibility of having sex tonight.*

The picture was the one used in the white condition in Experiment 1a. Participants viewed the picture, then completed the perceived attractiveness measure, a general likeability measure, and, finally, a manipulation check.

Perceived attractiveness was assessed with Mehrabian and Blum's (1997) 4-item measure (e.g., “Rate this person on facial attractiveness”;  $\alpha = .95$ ). General likeability was assessed with a face valid bipolar item measuring the degree to which the target female was perceived as unlikeable (1) to likeable (9). The high receptivity condition is also more positive in valence than the low receptivity condition, thus we sought to demonstrate an effect of sexual receptivity

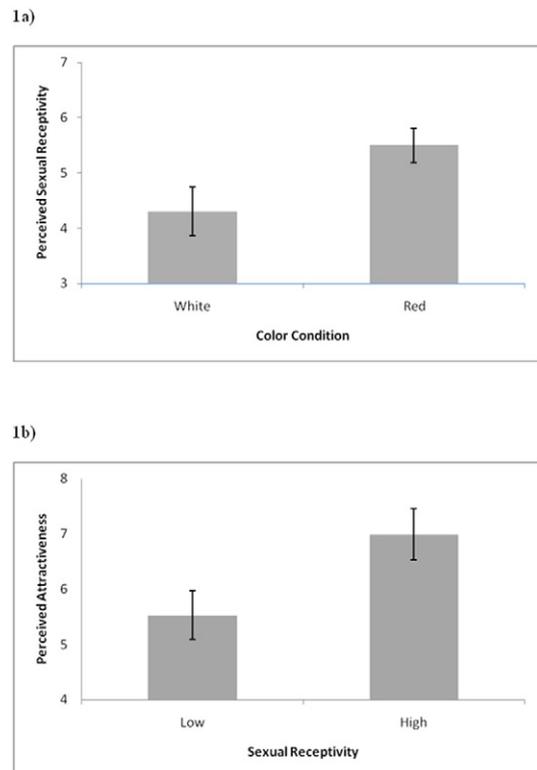


Fig. 1. a: The influence of shirt color on perceived sexual receptivity in Experiment 1a. b: The influence of sexual receptivity on perceived attractiveness in Experiment 1b.

condition on perceived attractiveness but not general likeability to highlight that the effect is receptivity specific. For the manipulation check, participants responded to the item “She is interested in sex.”

## Results

An independent samples *t*-test indicated that the manipulation was effective; participants in the high sexual receptivity condition rated the woman as more interested in sex ( $M = 6.73$ ,  $SD = 1.95$ ) than participants in the low sexual receptivity condition ( $M = 3.36$ ,  $SD = 2.06$ ),  $t(20) = 3.93$ ,  $p < .001$ . Another *t*-test revealed an effect of receptivity on perceived attractiveness,  $t(20) = 2.30$ ,  $p < .05$ ,  $d = 0.98$ . Participants in the high receptivity condition ( $M = 6.99$ ,  $SD = 1.54$ ) rated the woman as more attractive than those in the low receptivity condition ( $M = 5.53$ ,  $SD = 1.44$ ; Fig. 1b). Furthermore, no difference was observed between the high and low receptivity conditions on general likeability ( $p > .26$ ), indicating that receptivity specifically influenced judgments of attractiveness, not positive evaluations in general. Together, Experiments 1a and 1b document mediation via the experimental-causal-chain approach.

## Experiment 2

Experiment 2 tested both links in the mediational model simultaneously using the measurement-of-mediation approach (see Baron & Kenny, 1986). We also sought to rule out two alternative mediator variables. Green was used as a chromatic contrast to red; this allowed us to test the influence of hue while controlling the other two color properties, lightness and chroma.

## Method

Forty-nine males (ages 18–33,  $M = 23.5$ ) in Austria participated for course credit. All participants were Caucasian.

On arrival at the laboratory, participants were informed that the experiment was on first impressions. They were given a folder containing a picture of a moderately attractive young woman with dark brown hair, wearing either a red ( $n = 27$ ) or green ( $n = 22$ ) shirt. 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 4" × 6", printed on archival quality paper with an Epson Stylus Photo printer. Having participants complete the study in a laboratory setting allowed for more control of the color manipulation by assuring that each participant would see the color under identical lighting and presentation conditions. The target female and the shirt style were different from those used in the previous experiment. Shirt color was manipulated with Adobe Photoshop. 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 the same measure used in the prior experiment ( $\alpha = .66$ ). Perceived attractiveness was assessed with Elliot and Niesta's (2008) two-item measure (e.g., “How attractive do you think this person is?”;  $\alpha = .91$ ). Sexual desire was assessed with Elliot and Niesta's (2008) four-item measure (e.g., “How much do you find this person sexually desirable?”;  $\alpha = .89$ ). Perceived kindness was assessed with two face-valid items from Hatfield and Sprecher (1995; e.g., “How kind is this person?”;  $\alpha = .84$ ). Perceived intelligence was assessed with a single face-valid item from Dijkstra and Buunk's (2002; “How intelligent do you think this person is?”). The awareness question was the same used in the prior experiment.

## Results

Multiple regression was used to examine direct and indirect effects. Regressing the two outcome measures on color condition (red = 1, green = 0) revealed an effect for perceived attractiveness,  $F(1,47) = 5.02$ ,  $p < .05$  ( $\beta = .31$ ), and sexual desire,  $F(1,47) = 6.15$ ,  $p < .05$  ( $\beta = .34$ ), indicating that participants in the red condition rated the woman as more attractive and sexually desirable than participants in the green condition.

Regressing perceived sexual receptivity on color condition revealed a significant effect,  $F(1,47) = 4.75$ ,  $p < .05$  ( $\beta = .30$ ). Participants in the red condition rated the woman as higher in receptivity than participants in the green condition (Fig. 2).

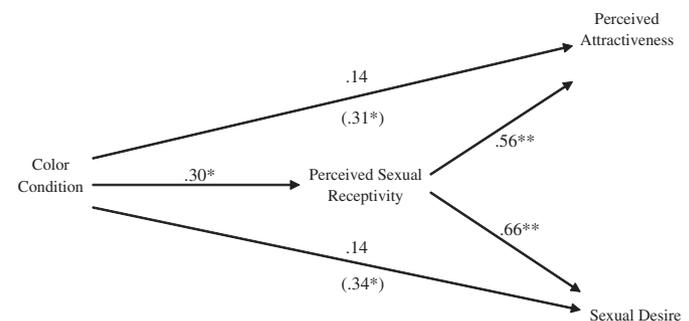
Finally, regressing perceived attractiveness on color condition with perceived sexual receptivity in the equation revealed that perceived sexual receptivity was a positive predictor of perceived attractiveness,  $F(1,46) = 20.60$ ,  $p < .001$  ( $\beta = .56$ ). Participants perceiving the woman as higher in receptivity found her more attractive. Color condition no longer significantly predicted perceived attractiveness ( $p = .25$ ), and the direct effect decreased 56%. The confidence intervals for the indirect effect, .064–1.22, generated using PRODCLIN (Mackinnon, 2008), did not include 0, further validating the mediational role of perceived sexual receptivity. Comparable results were observed for sexual desire. Perceived sexual receptivity was a positive predictor of sexual desire,  $F(1,47) = 37.24$ ,  $p < .001$  ( $\beta = .66$ ). Participants perceiving the woman as higher in receptivity found her more sexually desirable. Color condition no longer significantly predicted sexual desire ( $p = .20$ ), and the direct effect decreased 61%. The confidence intervals for the indirect effect, .068–1.28, did not include 0, further validating the mediational role of perceived sexual receptivity. These findings document mediation via the measurement-of-mediation approach.

Regressing perceived kindness and intelligence on color condition yielded null results ( $ps > .67$ ). No participant mentioned color when guessing the purpose of the experiment.

## General discussion

The present research provides strong support for our hypothesized mediational model. Women wearing red were perceived by men as more sexually receptive, and it is precisely this receptivity that men found attractive. We obtained our findings using two different contrast colors, two different female targets, and two different mediational approaches. We ruled out two alternative, like-valenced mediators, and found no evidence of participants' awareness of the effect.

A noteworthy aspect of our research was the documentation of mediation via two distinct approaches that nicely complement one another. Each approach has unique strengths and weaknesses, with



**Fig. 2.** The effect of color condition on perceived attractiveness and sexual desire mediated by perceived sexual receptivity in Experiment 2. Color condition is coded 0 = green, 1 = red. The values in the figure represent standardized coefficients from regression analyses; the values in parentheses are from analyses of direct effects. \* $p < .05$ ; \*\* $p < .01$ .

the strengths of one mapping onto the weakness of the other (e.g., the measurement-of-mediation approach relies solely on correlational data, but the experimental-causal-chain approach uses experimental manipulation to test each link in the model; Spencer et al., 2005). As such, documenting mediation with both approaches represents particularly strong support for our hypotheses.

Our data show that men view red as an indicator of women's sexual receptivity, but they are mute on the accuracy of these perceptions (i.e., whether women actually don red when feeling amorous). If accurate, our findings point to a nonverbal signal system that effectively facilitates sexual behavior. If inaccurate, our findings point to yet another way that men over-impute sexual meaning to women's behavior (Abbey, 1982).

From a pragmatic standpoint, our results suggest that women may need to be judicious in their use of red clothing. Wearing red may be a subtle, yet powerful way to communicate sexual interest to a targeted male, but in public settings replete with eager male receivers, a red signal may result in unwanted sexual advances. More generally, our finding that female red carries sexual meaning will likely be of considerable interest to fashion designers, marketers, and advertisers.

Our research represents the first test and first empirical documentation of mediation of the red-attraction link for men viewing women. This research not only demonstrates an analogous direct effect of red in human and non-human primates, but also demonstrates that an analogous psychological process is responsible for this effect as well. It is important to note, however, that our research was not designed to test the ultimate origins (societal, biological, or both) of the observed effect. Such questions, in both the human and non-human primate literatures, have proven intricate and involved (see Emery & Whitten, 2003; Simpson & Gangestad, 2001), and (considerable) additional research is needed before such questions can be answered.

We focused exclusively on red and intersexual communication herein, and future work could examine red and intrapersonal communication. For example, women may construe red displays by other women signals of their sexual availability, and this may have implications for mate guarding, jealousy, and rival derogation processes (Buss, 1988; Fisher & Cox, 2011). Future research could also focus on the distinction between short-term and long-term mate evaluation. We suspect our results are specific to the short-term case, as men do not find sexual receptivity displays appealing in potential long-term mates (Schmitt & Buss, 1996).

In closing, our research contributes, at both conceptual and applied levels, to an emerging literature on color and psychological functioning (Elliot & Maier, in press). Red, in particular, appears to be a subtle, yet surprisingly powerful and important environmental stimulus that may serve similar functions across species.

## References

- Abbey, A. (1982). Sex differences in attributions for friendly behavior: Do males misperceive females' friendliness? *Journal of Personality and Social Psychology*, 42, 830–838.
- Andersson, M. (1994). *Sexual selection*. Princeton, NJ: Princeton University Press.

- Baron, R. M., & Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology*, 51, 1173–1182.
- Beach, F. A. (1976). Sexual attractivity, proceptivity, and receptivity in female mammals. *Hormones and Behavior*, 7, 105–138.
- Bielert, C., Girolami, L., & Jowell, S. (1989). An experimental examination of the color component in visually mediated sexual arousal of the male chacma baboon (*Papio ursinus*). *Journal of the Zoological Society of London*, 219, 569–579.
- Bullivant, S. B., Selligren, S. A., Stern, K., Spencer, N. A., Jacob, S., Mennella, J. A., et al. (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 preference: Evolutionary hypotheses tested in 37 cultures. *The Behavioral and Brain Sciences*, 12, 1–49.
- Clark, A. P. (2008). Attracting interest: Dynamic displays of proceptivity increase the attractiveness of men and women. *Evolutionary Psychology*, 6, 563–574.
- Dijkstra, P., & Buunk, B. P. (2002). Sex differences in the jealousy-evoking effect of rival characteristics. *European Journal of Social Psychology*, 32, 829–852.
- Dixson, A. F. (1983). Observations on the evolution and behavioral significance of "sexual skin" in female primates. *Advances in the Study of Behavior*, 13, 63–106.
- Elliot, A. J., & Maier, M. A., in press. Color-in-context theory. *Advances in Experimental Social Psychology*.
- Elliot, A. J., & Niesta, D. (2008). Romantic red: Red enhances men's attraction to women. *Journal of Personality and Social Psychology*, 95, 1150–1164.
- Emery, M. A., & Whitten, P. L. (2003). Size of sexual swellings reflects ovarian function in chimpanzees (*Pan troglodytes*). *Behavioral Ecology and Sociobiology*, 54, 340–351.
- Fisher, M., & Cox, A. (2011). Four strategies used during intrasexual competition for mates. *Personal Relationships*, 18, 20–38.
- Hatfield, E., & Sprecher, S. (1995). Men's and women's preferences in marital partners in the United States, Russia, and Japan. *Journal of Cross-Cultural Psychology*, 26, 728–750.
- Hendrie, C. A., Mannion, H. D., & Godfrey, G. K. (2009). Evidence to suggest that night-clubs function as human sexual display grounds. *Behaviour*, 146, 1331–1348.
- Hutchings, J. (2004). Color in folklore and tradition—The principles. *Color Research and Application*, 29, 57–66.
- Jobes, G. (1962). *Dictionary of mythology, folklore, and symbols (Vols. 1–2)*. New York: Scarecrow Press.
- Low, B. S. (1979). Sexual selection and human ornamentation. In N. Chagnon, & W. Irons (Eds.), *Evolutionary biology and human social behavior* (pp. 462–487). North Sliuuate, MA: Duxbury Press.
- Lynn, B. M., McCord, J. L., & Halliwell, J. R. (2007). Effects of menstrual cycle and sex on progesterone dynamics. *American Journal of Physiology. Regulatory, Integrative and Comparative Physiology*, 292, R1260–R1270.
- MacKinnon, D. P. (2008). *Introduction to statistical meditational analysis*. Mahwah, NJ: Lawrence Erlbaum Associates.
- Mehrabian, A., & Blum, J. S. (1997). Physical appearance, attractiveness, and the mediating role of emotions. *Current Psychology*, 16, 23–42.
- Oliver, M. B., & Hyde, J. S. (1993). Gender differences in sexuality: A meta-analysis. *Psychological Bulletin*, 114, 29–51.
- 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.
- Schmitt, D. P., Couden, A., & Baker, M. (2001). The effects of sex and temporal context on feelings of romantic desire: An experimental evaluation of sexual strategies theory. *Personality and Social Psychology Bulletin*, 27, 833–847.
- Setchell, J. M., & Wickings, E. J. (2004). Sexual swelling in mandrills (*Mandrillus sphinx*): A test of the reliable indicator hypothesis. *Behavioral Ecology*, 15, 438–445.
- Simpson, J. A., & Gangestad, S. W. (2001). Evolution and relationships: A call for integration. *Personal Relationships*, 8, 341–355.
- Spencer, S. J., Zanna, M. P., & Fong, G. T. (2005). Establishing a causal chain: Why experiments are often more effective than mediational analyses in examining psychological processes. *Journal of Personality and Social Psychology*, 89, 845–851.
- Van den Berghe, P. L., & Frost, P. (1986). Skin color preference, sexual dimorphism, and sexual selection: A case of gene culture co-evolution. *Ethnic and Racial Studies*, 9, 87–113.
- Watt, C., Gerald, M. S., Little, A. C., & Krasieburd, E. (2006). Selective attention toward female secondary sexual characteristics. *American Journal of Primatology*, 68, 738–744.