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FlashReport

Evolution and relationship maintenance: Fertility cues lead committed men to devalue relationship alternatives

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ABSTRACT

An evolutionary perspective provides a conceptual framework with which to study adaptive processes that facilitate the maintenance of long-term relationships. One common relationship threat people face involves exposure to tempting relationship alternatives. Desirable relationship alternatives can threaten people's relationship commitment and, consequently, evoke relationship maintenance processes designed to protect people's relationship esteem. The current research examined whether cues of female ovulation–an important reproductive variable–evokes relationship maintenance processes in committed men. Men rated the attractiveness of a normally cycling relationship alternative at various points in her menstrual cycle. Unlike single men, who rated the woman as especially attractive when she was highly fertile, committed men exhibited the opposite pattern, rating her as less attractive during her period of peak fertility. This research illustrates the utility of integrating theories of relationship maintenance with evolutionary psychological theories of mating.

Committed, long-term romantic relationships are a central aspect of human life. Such relationships help fulfill people's fundamental needs for love and social affiliation and, from an evolutionary perspective, they often play a crucial role in ensuring people's reproductive success (Mellen, 1981).

Maintaining long-term relationships, however, can be challenging. One of the most potent threats to a long-term relationship is the presence of desirable alternatives to one's current partner. People sometimes are tempted by opportunities to form extra-pair romantic partnerships. This temptation can lower people's satisfaction with and commitment to their long-term relationships, potentially leading to relationship break-up (Kenrick, Neuberg, Zierk, & Krones, 1994; Miller, 1997; Rusbult, 1983). Consequently, people display relationship maintenance strategies designed to protect their relationships against threats posed by desirable relationship alternatives (Gonzaga, Haselton, Smurda, Davies, & Poore, 2008; Karremans & Verwijmeren, 2008; Maner, Gailliot, & Miller, 2009; Plant, Kunstmand, & Maner, 2010). For example, individuals in committed relationships downplay the positive characteristics (e.g., physical attractiveness) of relationship alternatives (e.g., Lydon, Fitzsimons, & Naidoo, 2003; Simpson, Gangestad, & Lerma, 1990). By devaluing alternative relationship partners, people are less tempted to stray from their current relationship. Indeed, the devaluation of alternative mating partners plays a key role in helping people maintain commitment to an existing romantic partnership.

Relationship maintenance strategies are evoked in some situations more than others. Not all alternatives pose equivalent threats to one's relationship, and maintenance strategies are evoked most strongly when people are exposed to relationship alternatives who seem particularly enticing (Lydon, Meana, Sepinwall, Richards, & Mayman, 1999). For example, an undesirable or romantically uninterested individual is not as likely to pose a threat as an attractive person interested in forming new relationships would be. Consequently, relationship maintenance processes such as devaluation of relationship alternatives tend to be displayed primarily in response to alternatives who are highly desirable and attainable and, therefore, highly threatening to one's relationship commitment.

Previous research on the threatening effects of relationship alternatives has focused almost exclusively on responses to desirable characteristics that are highly overt—characteristics such as physical attractiveness and social status that are easy to observe and consciously process. When exposed to alternatives possessing such characteristics, people presumably are aware of the threat those alternatives pose to relationship esteem and thus respond with processes designed to protect their relationship esteem (Ritter, Karremans, & van Schie, in press). However, this leaves open the question—might relationship maintenance processes also occur in response to relatively "invisible," but reproductively important, characteristics displayed by others?

Recent work suggests that people's romantic desires are strongly influenced by subtle, relatively covert characteristics in other people

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(e.g., scent; Garver-Apgar, Gangestad, & Thornhill, 2008; Thornhill et al., 2003). Many of these subtle characteristics lead to romantic attraction because they signal aspects of others that are reproductively important (e.g., good genes; Thornhill et al., 2003). In the current paper we suggest that covert but reproductively important characteristics in others also exert effects on relationship maintenance processes.

From an evolutionary perspective, one of the most important mating-related qualities a relationship partner can possess is a high level of reproductive fertility. Unlike men, whose fertility remains relatively constant across time, women experience dramatic fluctuations in their fertility across the menstrual cycle. In women, fertility levels peak during the few days before ovulation and the day of ovulation itself (Wilcox, Weinberg, & Baird, 1995). The probability of conception outside this brief fertile window is practically nil.

Given the central role that fertility plays in reproduction, evolutionary theories posit that most men are especially attracted to women near ovulation (Gangestad, Thornhill, & Garver-Apgar, 2005). Indeed, in myriad species, cues of fertility (e.g., sexual swellings on the hindquarters of female primates) tend to heighten male mating behavior (Ziegler, Schultz-Darken, Scott, Snowdon, & Ferris, 2005).

In humans, unlike many other species, women do not exhibit highly overt physical indicators of fertility. As a result, scientists historically assumed that women's fertility levels were concealed (Burley, 1979). However, recent studies indicate otherwise. Men, for example, subjectively evaluate the odors, voices, and facial skin tones of women close to ovulation as more pleasant than those of women far from ovulation (Pipotone & Gallup, 2008; Roberts et al., 2004; Thornhill et al., 2003). Subtle cues of female fertility also lead to heightened testosterone levels in men, a physiological indicator of men's heightened mating motivation (Miller & Maner, 2010). Thus, subtle cues of female fertility tend to evoke romantic attraction in most men (Miller, Tybur, & Jordan, 2007).

Although subtle signs of female fertility generally evoke feelings of romantic attraction in men, there is reason to think that such signs might elicit relationship maintenance processes in men already in a committed romantic relationship. Because indicators of fertility tend to increase a woman's attractiveness, they might evoke in committed men relationship-protective processes designed to down-regulate the relationship threat.

The current study is the first to test the hypothesis that signs of female fertility evoke relationship maintenance processes in committed men. Male participants rated the attractiveness of a female confederate at different points in her menstrual cycle. We predicted that, whereas single participants would rate the confederate as more attractive when her fertility level was high as compared to low, committed men would show the opposite pattern, rating the confederate as less attractive (i.e., devaluing her) when her fertility level was high as compared to low.

Methods

Participants

Thirty-eight undergraduate men (age range: 18-26) participated for course credit. Twelve participants reported currently being in a romantic relationship.[1]

Confederate fertility

A 21-year-old woman with a regular menstrual cycle and not taking hormonal contraceptives served as a confederate. To avoid ceiling and floor effects, we chose a confederate who was approximately average in attractiveness. The confederate interacted with participants on various days across three of her menstrual cycles (average cycle length: 28.7 days). To ensure that effects would be caused by covert cues (e.g., scent and changes in skin tone) rather than by overt behaviors on the part of the confederate, she underwent extensive training on how to remain expressively neutral when interacting with participants; she kept eye contact and conversation to a minimum, responding with only brief but polite answers to questions posed by the participant. To further standardize the procedure, the confederate did not wear make-up, put her hair in a ponytail, and wore jeans and a plain t-shirt. Additionally, because scent is one mechanism by which men identify women's fertility levels (Miller & Maner, 2010; Singh & Bronstad, 2001; Thornhill et al., 2003), we minimized extraneous odors by having her prepare for each session by showering with unscented soap and shampoo and refraining from using deodorant or perfume. Although the confederate was aware that the study involved her menstrual cycle (as she had to track the timing of her cycle), she was unaware of the specific hypotheses. She was also unaware of the participant's relationship status.

Procedure

Male participants arrived at a waiting room where another female student (the confederate) was waiting. An experimenter guided them to a lab room, where they performed several cooperative tasks for 20 min. The interaction between the confederate and participant was surreptitiously recorded via a camera on the wall.

After the interaction, participants completed a brief questionnaire alone. They indicated how intelligent, flirtatious, outgoing, and attractive the confederate was using 5-point scales (1 = "Not at all"; 5 = "Extremely").

Results

Calculation of conception risk

Consistent with previous psychological research on menstrual cycle effects (Navarrete, Fessler, Fleischman, & Geyer, 2009), conception risk values were estimated according to the day of the confederate's cycle on which the interaction took place (see Wilcox, Dunson, Weinberg, Trussell, & Baird, 2001). Higher values on this measure indicate a higher likelihood of possible conception (i.e., higher levels of fertility).[2]

Ratings of attractiveness

Participants' ratings of the confederate's attractiveness were regressed on participants' relationship status (single vs. committed), confederate's conception risk, and their centered interaction. Results revealed a main effect of relationship status, $\beta = .32$, $p = .04$, partial $r^2 = .12$, such that single men rated the confederate as more attractive than committed men did; this replicates the typical devaluation of relationship alternatives finding observed in the literature. However, this main effect was qualified by the predicted interaction between relationship status and conception risk, $\beta = .40$, $p = .01$, partial $r^2 = .17$. Analyses of simple slopes revealed a marginally significant positive relationship between conception risk and ratings of attractiveness among single men, $\beta = .30$, $p = .09$, partial $r^2 = .08$, but a significant negative relationship between conception risk and ratings

[1] Participants were part of a study reported elsewhere (Miller & Maner, in press). However, data presented here were not reported in that article.

[2] Participation of both single and committed men was normally and equivalently distributed across conception risk values (single men: *Mean conception risk* = .034, *SD* = .32; committed men: *Mean conception risk* = .034, *SD* = .031; Levine test: $F(1,36) = .15$, $p = .70$).

of attractiveness among committed men, $\beta = -.57$, $p = .04$, partial $r^2 = .11$ (see Fig. 1).

We also examined the effect of men's relationship status on attractiveness ratings of the confederate at one standard deviation above and below the mean of conception risk ($M = .034$, $SD = .032$). Values of conception risk equal to and greater than one standard deviation above the mean corresponded to days 11 to 15 of the confederate's cycle; values equal to or lower than one standard deviation below the mean corresponded to days 1 to 4 of the confederate's cycle. At high levels of conception risk (1 *SD* above the mean), committed men rated the confederate as less attractive than single men did, $\beta = .73$, $p = .002$, partial $r^2 = .26$. At low levels of conception risk (1 *SD* below the mean), there was no difference in men's ratings of attractiveness, $\beta = -.10$, $p = .66$, partial $r^2 < .01$.

Ancillary analyses

To provide evidence for specificity in men's evaluations of attractiveness, additional analyses examined whether other perceptions of the confederate changed across the menstrual cycle. Participants' ratings of intelligence, flirtatiousness, and extroversion were subjected to the same regression analyses mentioned previously. Main effects of relationship status on ratings of intelligence, $\beta = .39$, $p = .02$, partial $r^2 = .16$, and extraversion, $\beta = -.31$, $p = .05$, partial $r^2 = .10$, were observed, such that single men rated the confederate as more intelligent and less outgoing than committed men did. Importantly, however, we did not observe any significant main effects or interactions associated with conception risk on these dependent variables (all p's $> .15$).

Two independent female raters, unaware of hypotheses and phase of the confederate's cycle, also indicated how flirtatious, outgoing, and attractive the confederate appeared to be in the videotaped interactions. Analyses of these ratings confirmed that the confederate's behavior (flirtatiousness and outgoingness) did not significantly vary as a function of her conception risk or participants' relationship status or their interaction. Moreover, there was no relationship between objective ratings of attractiveness ($M = 3.1$, $SD = .58$) and the confederate's level of conception risk, $p = .45$. Thus, shifts in the confederate's fertility influenced only the male participants' evaluations of her attractiveness.[3]

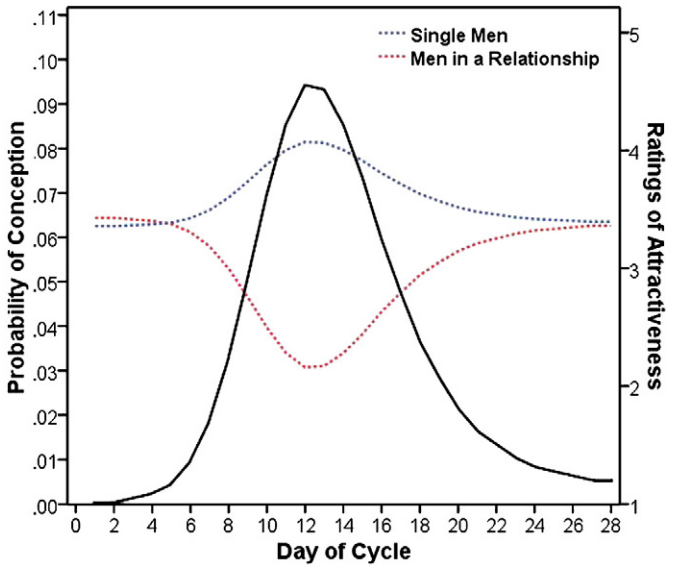

Fig. 1. Among single men, conception risk of the confederate was positively related to men's ratings of the female confederate's attractiveness. Among men in a relationship, female conception risk was negatively related to men's ratings of the confederate's attractiveness. Solid line = probability of conception risk for each day of the cycle as generated by Wilcox et al. (2001). Dotted lines = estimated ratings of attractiveness from the regression model.

Discussion

Exposure to a woman in the reproductively fertile window of her menstrual cycle led committed men to devalue the woman's attractiveness. Consistent with previous research (Miller et al., 2007), single men rated the woman as more attractive when she was highly fertile. In contrast, committed men rated her as less attractive when she was highly fertile. The current study thus provides the first evidence that female fertility cues evoke relationship maintenance processes in committed men.

Devaluing alternative relationship partners plays a key role in helping people maintain their relationship esteem. Previous research indicates that as the level of relationship threat increases, so too does the degree of relationship maintenance (Lydon et al., 1999; Maner, Rouby, & Gonzaga, 2008). The current research suggests that relationship maintenance processes are calibrated not only to highly overt characteristics in alternative relationship partners; they are also calibrated to highly subtle, yet reproductively important, cues displayed by other people. The current findings reveal a heretofore hidden aspect of the processes through which people might maintain long-term romantic relationships.

At a broader theoretical level, these findings highlight the utility of examining people's romantic lives through the lens of adaptationist thinking. Evolutionary psychology provides a framework for generating novel predictions about the psychological processes through which people enhance their reproductive success. The majority of evolutionarily inspired research on mating has focused on romantic attraction and mate selection; much less work has focused on the maintenance of long-term relationships. However, such relationships serve important adaptive functions associated with childcare and social affiliation (Baumeister & Leary, 1995; Taylor et al., 2000) and, from an evolutionary perspective, many relationship maintenance processes reflect adaptive mechanisms designed to enhance reproductive success by protecting long-term relationships from threats posed by alternative partners (Gonzaga, Keltner, Londahl, & Smith, 2001). By identifying key reproductively relevant variables such as a woman's level of fertility, an evolutionary perspective helps one generate hypotheses about the types of characteristics that are likely to be most alluring and, consequently, most threatening to long-term relationships.

One limitation of the current work is that men were exposed to fertility cues only from a novel woman—someone they did not know. Fertility cues are likely to evoke different responses when those cues are displayed by a man's long-term partner. Rather than downplaying the attractiveness of their partner during periods of high fertility, committed men might instead increase the value they place on the relationship. Indeed, some research suggests that men respond to a partner's heightened fertility with increased mate-guarding and attention to intrasexual rivals—processes associated with heightened interest in maintaining a partner's commitment (Burriss & Little, 2006; Haselton & Gangestad, 2006). Future research would benefit from examining how committed men respond differently to reproductively important cues displayed by their long term partner versus relationship alternatives.

Another limitation of the current work is that we examined only one type of relationship maintenance process—explicit devaluation of a relationship alternative. By doing so, we were able to place the current study within a wider literature on the devaluation of relationship alternatives, a phenomenon typically demonstrated

[3] Including video raters' ratings of outgoingness, flirtatiousness, and attractiveness as covariates in the primary regression analyses only slightly reduced the interaction between relationship status and conception risk, $\beta = .37$, $p = .06$.

through the use of explicit measures such as self-reported judgments of attractiveness (Lydon et al., 1999, 2003; cf. Karremans & Verwijmeren, 2008). However, the extent to which fertility cues might lead men to devalue relationship alternatives in other ways is less clear. Other research suggests that, at the level of implicit processes (e.g., semantic activation of sexual thoughts; implicit affiliative behaviors) committed men and single men may be similarly responsive to signs of female fertility (Miller & Maner, in press). Future research, therefore, is needed to delineate the effect of fertility on explicit versus implicit relationship maintenance processes.

The social mind has evolved to solve many of life's recurring social challenges. In identifying a new and important aspect of relationship maintenance, the current work connects social psychological research on close relationships with a burgeoning evolutionary literature on long-term mating. Integrating evolutionary theories of mating with social cognitive theories of relationship maintenance provides a valuable framework with which to understand the adaptive aspects of relationship cognition.

References

Baumeister, R. F., & Leary, M. R. (1995). The need to belong: desire for interpersonal attachments as a fundamental human motivation. *Psychological Bulletin*, *117*, 497—529.

Burley, N. (1979). Evolution of concealed ovulation. *American Naturalist*, *114*, 835—858.

Burriss, R. P., & Little, A. C. (2006). Effects of partner conception risk phase on male perception of dominance in faces. *Evolution and Human Behavior*, *27*, 297—305.

Gangestad, S. W., Thornhill, R., & Garver-Apgar, C. E. (2005). Adaptations to ovulation: implications for sexual and social behavior. *Current Directions in Psychological Science*, *14*, 312—316.

Garver-Apgar, C. E., Gangestad, S. W., & Thornhill, R. (2008). Hormonal correlates of women's mid-cycle preference for the scent of symmetry. *Evolution and Human Behavior*, *29*, 223—232.

Gonzaga, G. C., Haselton, M. G., Smurda, J., Davies, M., & Poore, J. C. (2008). Love, desire, and the suppression of thoughts of romantic alternatives. *Evolution and Human Behavior*, *29*, 119—126.

Gonzaga, G. C., Keltner, D., Londahl, E. A., & Smith, M. D. (2001). Love and the commitment problem in romantic relationships. *Journal of Personality and Social Psychology*, *2*, 247—262.

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.

Karremans, J. C., & Verwijmeren, T. (2008). Mimicking attractive opposite-sex others: The role of romantic relationship status. *Personality and Social Psychology Bulletin*, *34*, 939—950.

Kenrick, D. T., Neuberg, S. L., Zierk, K. L., & Krones, J. M. (1994). Evolution and social cognition: contrast effects as a function of sex, dominance, and physical attractiveness. *Personality and Social Psychology Bulletin*, *20*, 210—217.

Lydon, J. E., Fitzsimons, G. M., & Naidoo, L. (2003). Devaluation versus enhancement of attractive alternatives: a critical test of the commitment calibration paradigm. *Personality and Social Psychology Bulletin*, *29*, 349—360.

Lydon, J. E., Meana, M., Sepinwall, D., Richards, N., & Mayman, A. (1999). The commitment calibration hypothesis: when do people devalue attractive alternatives? *Personality and Social Psychology Bulletin*, *25*, 152—161.

Maner, J. K., Gailliot, M. T., & Miller, S. L. (2009). The implicit cognition of relationship maintenance: inattention to attractive alternatives. *Journal of Experimental Social Psychology*, *45*, 174—179.

Maner, J. K., Rouby, D. A., & Gonzaga, G. C. (2008). Automatic inattention to attractive alternative: the evolved psychology of relationship maintenance. *Evolution and Human Behavior*, *29*, 343—349.

Mellen, S. L. W. (1981). *The evolution of love*. Oxford, England: Freeman.

Miller, S. L., & Maner, J. K. (in press). Ovulation as a male mating prime: Subtle signs of female fertility influence men's mating cognition and behavior. *Journal of Personality and Social Psychology*.

Miller, S. L., & Maner, J. K. (2010). Scent of a woman: men's testosterone responses to olfactory ovulation cues. *Psychological Science*, *21*, 276—283.

Miller, R. S. (1997). Inattentive and contented: relationship commitment and attention to alternatives. *Journal of Personality and Social Psychology*, *73*, 758—766.

Miller, G., Tybur, J. M., & Jordan, B. D. (2007). Ovulatory cycle effects on tip earnings by lap dancers: economic evidence for human estrus? *Evolution and Human Behavior*, *28*, 375—381.

Navarrete, C. D., Fessler, D. M. T., Fleischman, D. S., & Geyer, J. (2009). Race bias tracks conception risk across the menstrual cycle. *Psychological Science*, *20*, 661—665.

Pipotone, R. N., & Gallup, G. G. (2008). Women's voice attractiveness varies across the menstrual cycle. *Evolution and Human Behavior*, *29*, 268—274.

Plant, E. A., Kunstmand, J. W., & Maner, J. K. (2010). You do not only hurt the one you love: self-protective responses to attractive relationship alternatives. *Journal of Experimental Social Psychology*, *46*, 474—477.

Ritter, S. M., Karremans, J. C., & van Schie, H. T. (in press). The role of self-regulation in derogating attractive alternatives. *Journal of Experimental Social Psychology*.

Roberts, S. C., Havlíček, J., Flegr, J., Hruskova, M., Little, A. C., Jones, B. C., et al. (2004). Female facial attractiveness increases during the fertile phase of the menstrual cycle. *Proceedings of the Royal Society of London, B*, *21*, 270—272.

Rusbult, C. E. (1983). A longitudinal test of the investment model: the development (and deterioration) of satisfaction and commitment in heterosexual involvements. *Journal of Personality and Social Psychology*, *45*, 101—117.

Simpson, J. A., Gangestad, S. W., & Lerma, M. (1990). Perception of physical attractiveness: mechanism involved in the maintenance of romantic relationships. *Journal of Personality and Social Psychology*, *6*, 1192—1201.

Singh, D., & Bronstad, P. M. (2001). Female body odour is a potential cue to ovulation. *Proceedings of the Royal Society of London*, *268*, 797—801.

Taylor, S. E., Klein, L. C., Lewis, B. P., Gruenewald, T. L., Gurung, R. A. R., & Updegraff, J. A. (2000). Biobehavioral responses to stress in females: tend-and-befriend, not fight-or-flight. *Psychological Review*, *107*, 411—429.

Thornhill, R., Gangestad, S. W., Miller, R., Scheyd, G., McCollough, J. K., & Franklin, M. (2003). Major histocompatibility complex genes, symmetry, and body scent attractiveness in men and women. *Behavioral Ecology*, *14*, 668—678.

Wilcox, A. J., Dunson, D. B., Weinberg, C. R., Trussell, J., & Baird, D. D. (2001). Likelihood of conception with a single act of intercourse: providing benchmark rates for assessment of post-coital contraceptives. *Contraception*, *63*, 211—215.

Wilcox, A. J., Weinberg, C. R., & Baird, D. D. (1995). Timing of sexual intercourse in relation to ovulation: effects on the probability of conception, survival of the pregnancy and sex of the baby. *New England Journal of Medicine*, *333*, 1517—1521.

Ziegler, T. E., Schultz-Darken, N. J., Scott, J. J., Snowdon, C. T., & Ferris, C. F. (2005). Neuroendocrine response to female ovulatory odors depends upon social condition in male common marmosets (*Callithrix jacchus*). *Hormones and Behavior*, *47*, 56—64.