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Women's Hormonal Status and Mate Value Influence Relationship Satisfaction and Perceived Male Attractiveness

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Abstract

Numerous findings suggest that female preferences for certain features of male faces vary during the menstrual cycle. Similarly, changes during the cycle have also been found in women's commitment to a current relationship. Furthermore, from the perspective of securing benefits from extra-pair affairs, the differences between women with high vs. low mate value could be expected. In this study we have tried to connect these sets of findings: first, we explored differences between partnered and single women in their ratings of male facial attractiveness in different phases of the menstrual cycle; and second, their satisfaction with the current relationship in relation to the cycle phase and self-perceived mate value. Two groups of women (single vs. partnered) rated the attractiveness of two sets of male faces (normal vs. symmetrical). Repeated measures ANOVA showed that women in a relationship gave higher ratings of attractiveness for both normal and symmetrical faces in the luteal phase compared to the early follicular phase of a cycle, while single women showed the opposite pattern. Analyses of satisfaction with their current relationship in relation to cycle phase and self-perceived mate value showed that women with higher mate value are generally more satisfied with their current partners, and show smaller differences in satisfaction in various phases of the cycle. The results are interpreted in terms of content-specificity of hormone mediated adaptive design.

INTRODUCTION

Numerous findings suggest that female preferences for different male features (e.g. symmetry, masculinity, apparent health and self-resemblance) vary during the menstrual cycle (Johnston, Hagel, Franklin, Fink & Grammer, 2001; Penton-Voak *et al.*, 1999; Penton-Voak & Perrett, 2000; 2001; Jones, Perrett *et al.*, 2005;

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DeBruine, Jones & Perrett, 2005). Women's preferences for presumed good genes indicators tend to be highest in the late follicular phase of the menstrual cycle, when the likelihood of conception is increased: facial masculinity (Johnston *et al.*, 2001; Penton-Voak *et al.*, 1999; Penton-Voak & Perrett, 2000), vocal masculinity (Feinberg *et al.*, 2006), symmetry and body scents associated with it (Thornhill & Gangestad, 1999; Rikowski & Grammer, 1999), so that they might gain heritable benefits. On the other hand, during the mid-luteal phase (which is hormonally similar to pregnancy, due to increased levels of both estrogen and progesterone), women prefer less masculinized (Penton-Voak & Perrett, 2000) or self-resembling faces (DeBruine, Jones & Perrett, 2005), i.e. those indicating prosociality and willingness for investment, and healthier looking faces (Jones, Little *et al.*, 2005; Jones, Perret *et al.*, 2005), associated with lower risks of infection. These cyclic shifts are considered as evidence for a hormone- mediated adaptive design (Gangestad, Thornhill & Garver-Apgar, 2005). Through mate choice adaptations women can secure benefits for their offspring, either through males' parental care or through heritable genetic benefits (good genes) (Buss & Schmitt, 1993; Gangestad & Simpson, 2000). The greatest benefit for the offspring can be conferred through both paternal care and good genes by long-term partners. However, men displaying indicators of genetic quality would be in high demand on the mating market, so that only women with high mate value could attract long-term mates with good genes. Furthermore, due to the attractiveness of men with good genes and a high demand for them as sex partners, they become more oriented toward mating than to providing paternal care. Women who could not attract long-term mates with good genes could have benefited from this fact, obtaining genetic benefits from short-term relationships with such partners, while at the same time securing investment from their long-term mates (Penton-Voak *et al.*, 1999; Haselton & Gangestad, 2006). The benefits from such mating could be obtained only in the period when conception is most probable. In other words, in choosing a primary partner, women can trade off good genes for investment, and then pursue extra-pair mating with attractive (good genes) men. This notion is supported by the findings that shifts in facial masculinity preferences during the fertile phase have been observed when women evaluated men's faces for short-term relationship (Penton-Voak *et al.*, 1999) and when the relationship context was not specified (Johnston *et al.*, 2001; Penton-Voak & Perret, 2000; Penton-Voak *et al.*, 1999). Furthermore, it has been shown that during the fertile phase of the menstrual cycle women are more likely to engage in extra-pair copulations (Bellis & Baker, 1990), have more sexual fantasies about men other than women's own romantic partner (Gangestad, Thornhill & Garver, 2002), greater extra-pair flirtation (Haselton & Gangestad, 2006) or report less commitment to the current relationship (Jones, Little *et al.,* 2005).

Preferences for male facial masculinity and symmetry, as well as cyclic shifts in those preferences are influenced by the attractiveness (Little, Burt, Penton-Voak & Perrett, 2001; Penton-Voak *et al.*, 2003) and relationship status (Haselton & Gangestad, 2006; Fink & Penton-Voak, 2002) of female judges. Attractive women

may secure masculine men as long-term partners, and thus obtain their good genes as well as their investment. Therefore, the trade-off between good genes and investment is of little importance for them and they should show weaker effects of a relationship context and smaller preference shifts during the menstrual cycle (Feinberg *et al.*, 2006). As for the influence of the relationship status, it was shown that pair-bonded women showed larger cyclic shifts than women who are not pair-bonded (Fink & Penton-Voak, 2002), and a greater increase in attraction to other men in the high-fertility phase if they were mated to men rated low in sexual attractiveness (Haselton & Gangestad, 2006).

The aim of this study was to connect these sets of findings and to explore the interplay among women's hormonal status, current relationship status, self-perceived mate value, and ratings of male facial attractiveness. First, we wanted to explore the differences in ratings of male facial attractiveness given by women who were currently in a romantic relationship vs. single women, as a function of hormonal changes during the menstrual cycle. Furthermore, we were interested in determining whether satisfaction with one's own romantic relationship depends upon the current hormonal status and self-perceived mate value. It is plausible to suppose that women with higher mate value (being attractive and in the position to choose) are in a relationship with the partner of their choice, which might influence their ratings of satisfaction with the relationship. We hypothesize that there might be a proximal hormonal mechanism influencing both woman's satisfaction with her current partner and attractiveness of other men, which could ultimately result in her choice of reproductive strategy. Furthermore, if this is the case, and if shifts in preferences are not conscious and deliberate choices, but hormonally mediated adaptive responses, not only natural hormonal variations across the menstrual cycle, but also exogenous estrogens and progestins (such as those used in oral contraceptives) should modulate preferences in a similar manner.

METHODOLOGY

Participants

A total of 102 women participated in the study: 74 with natural menstrual cycles (average length of menstrual cycle was 28.26 days; SD = 1.77), and 28 using oral contraceptives. Participants' average age was 21.8 (SD = 2.20). At the time of testing, 23 women from the natural cycle group were in an early follicular phase (days 1-7 of cycle) – a period in the cycle during which both estrogen and progesterone are low (hereafter low EP phase); 11 women were in the late follicular phase (no more than 3 days before expected ovulation) – a period in the cycle during which estrogen is high and progesterone low; 30 women were in the mid-luteal phase of the cycle (10-3 days before expected menstruation) – a period during which both estrogen and progesterone are high (hereafter high EP phase).

Ten women were excluded from further analyses because the phase of the cycle could not be determined (they either had irregular cycles or they did not meet the criteria to be classified in any of the phases), so that 64 participants remained in the natural cycle group. All participants from the oral contraceptive group used triphasic pills. At the time of testing, 20 of them were in the first three weeks of the cycle (a period during which pills are taken, and estrogen and progesterone levels are high – hence high EP phase), and 8 were in the fourth week of the oral contraceptive cycle (a period during which pills are either not taken or they contain sugar and other non-steroid compounds – hence low EP phase).

Of these 92 participants, 54 reported that they were currently in a committed relationship (the subsample used in the second analysis), while 38 reported being single.

Procedure

Participants were tested individually. They were sitting in front of a PC monitor and watching a Power Point presentation with photographs of male faces. There was one photograph on each slide and 40 photographs altogether - 20 normal faces, and 20 symmetrical versions of the same faces. Participants were instructed to rate each face on a scale from 1 to 7 (1 meaning "very unattractive" and 7 meaning "very attractive"). They also filled out questionnaires regarding their menstrual cycle, self-perceived mate value, current relationship status, and satisfaction with their relationship if they were in one.

Instruments

Photographs of Male Faces

Twenty young men were photographed en face. They were instructed to keep a neutral facial expression. Their portraits were then manipulated, using Adobe Photoshop (version 7.0), to make two sets of symmetric faces: one set made of the left halves of model faces (hereafter left-mirrored), and the other set made of the right halves of model faces (hereafter right-mirrored). The line of symmetry was defined as the vertical midline between the left and right pupil. As a preliminary procedure, 65 female participants (not the same ones that participated in the study) rated the attractiveness of those 3 versions of 20 male faces (normal, left-mirrored and right-mirrored). Repeated measures ANOVA of their ratings showed there was a significant difference in perceived attractiveness of normal, left- and right-mirrored faces ($F(63,2) = 13.35$; $p < .001$). Post hoc Bonferroni tests revealed that normal faces did not differ in attractiveness from left-mirrored faces, while right-mirrored faces were less attractive than both normal and left-mirrored faces. On the basis of these results, only normal and left-mirrored faces were used in the study, thus ensuring that potential shifts in preferences could be attributed only to

symmetry itself and not to overall differences in attractiveness of stimuli faces. The example of normal and left-mirrored photographs is shown in Figure 1.

Figure 1. The Example of Normal and Left-Mirrored Face

Mate Value Inventory

The Mate value inventory (MVI-7; Kirsner, Figueredo & Jacobs, 2003) consists of 17 items – attributes usually considered to be important aspects of one's mate value (such as attractive face, attractive body, healthy, intelligent, faithful, etc.). Participants were instructed to rate themselves on each of 17 attributes, on a scale from –3 (extremely low on this trait) to +3 (extremely high on this trait). The answers were recoded to a scale from 1 to 7 and a mean score was computed.

Menstrual Cycle Questionnaire

Participants were asked about use of oral contraceptives, regularity and length of their menstrual cycles, as well as the date of their last menstruation (calendars and more detailed instructions were provided by the researcher, when needed).

Current Relationship Status and Satisfaction With the Relationship

Participants were asked whether they were currently in a committed relationship, and, if they answered "yes", to rate their satisfaction with the relationship on a scale from 1 to 5 (1 meaning "completely unsatisfied", and 5 meaning "completely satisfied").

RESULTS

1.) Attractiveness Ratings, Depending on Target Face Symmetry and the Rater's Current Relationship and Hormonal Status

Women With Natural Cycles

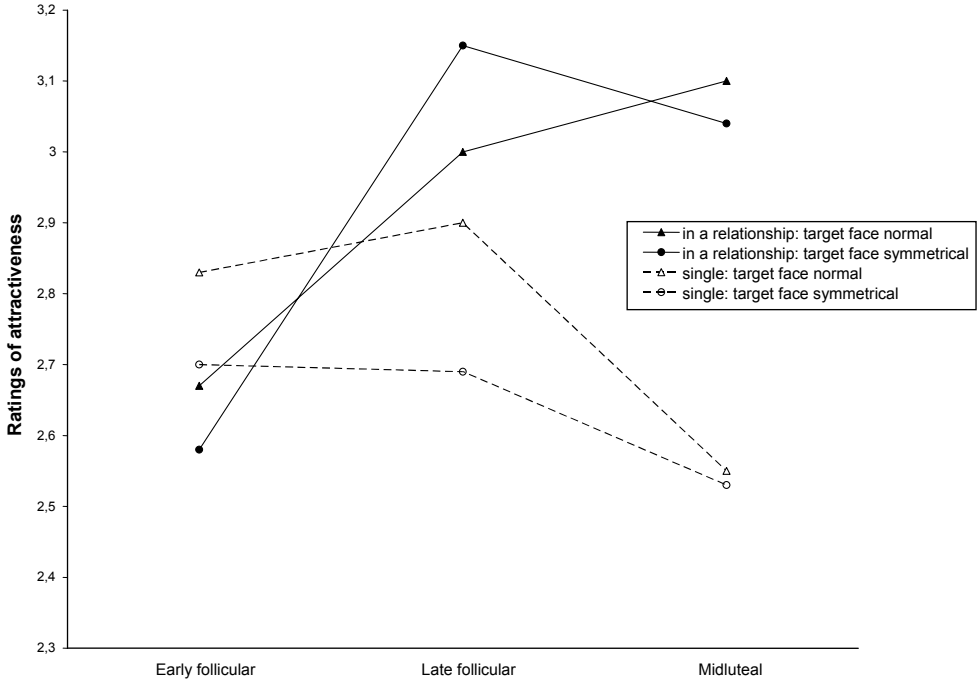
Repeated measures analysis of variance, with symmetry of target face as within-subjects source of variance (normal vs. symmetrical), and phase of the menstrual cycle (early follicular, late follicular, mid-luteal) and relationship status (single vs. pair-bonded) as between-subjects sources of variance showed a significant main effect of symmetry, and significant interactions between symmetry x relationship status, as well as symmetry x relationship status x phase of cycle (see Table 1).

Table 1. Results of Repeated Measures ANOVA

Source of variance	df	F	p
Symmetry	58/1	5.12	.03
Phase of cycle	58/2	0.32	.73
Relationship status	58/1	0.89	.35
Symmetry x phase of cycle	58/2	0.94	.39
Symmetry x relationship status	58/1	4.69	.03
Symmetry x phase of cycle x relationship status	58/2	3.714	.03

Average ratings, depending on the symmetry of target faces and the participant's current relationship and hormonal status are shown in Figure 2. Overall, participants rated normal faces as more attractive than symmetrical ones. Women in a relationship gave higher ratings of attractiveness for both normal and symmetrical faces in those phases of the cycle when estrogen and progesterone levels are high, compared to the phase when they are low, while single women showed the opposite pattern.

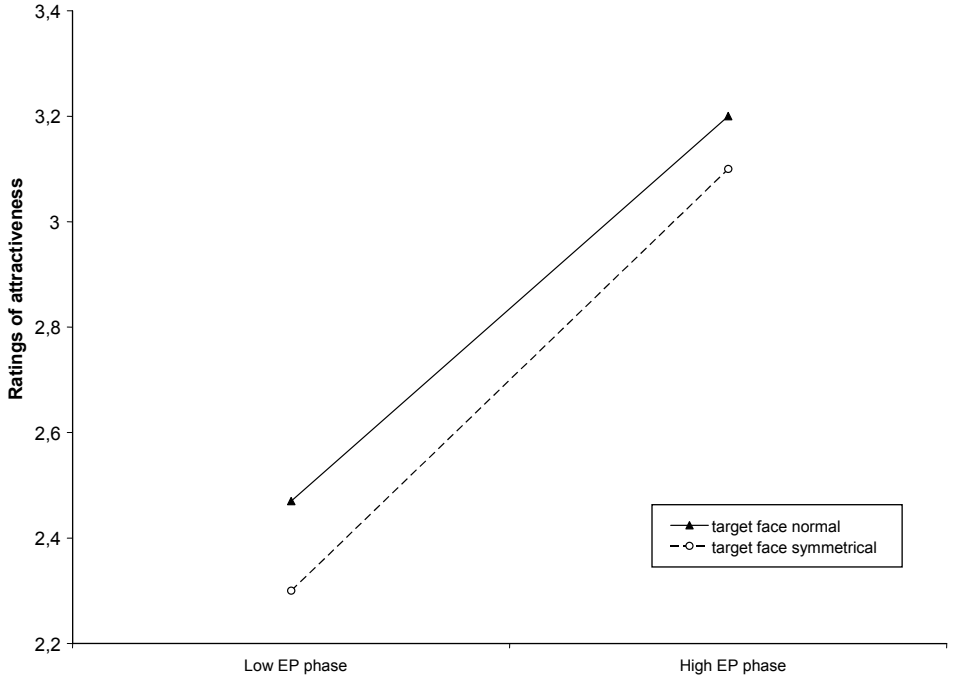
Figure 2. Ratings of Attractiveness of Symmetrical and Non-Symmetrical Male Faces, Depending on Phase of the Menstrual Cycle and Current Relationship Status of Raters



Women Using Oral Contraceptives

The results of ANOVA with the symmetry of target face (normal vs. symmetrical) as within-subjects source of variance and phase of cycle (low EP vs. high EP) as between-subjects source of variance showed significant main effects of both symmetry of target face ($F(26,1) = 11.56$, $p < .01$) and cycle phase ($F(26,1) = 4.31$, $p < .05$), without interaction ($F(26,1) = 0.57$, $p > .05$). The relationship status was not included as the source of variance, since all members of this group reported being in a relationship. As can be seen from Figure 3, the pattern resembles that obtained in the group of pair-bonded women with natural cycles. Both groups showed greater preference for all target faces, irrespective of their symmetry, during the phase of cycle when both estrogen and progesterone levels are high. Further analyses were performed to test whether changes in women's satisfaction with current partners occurred during this time interval.

Figure 3. Ratings of Attractiveness of Symmetrical and Non-Symmetrical Male Faces in Different Phases of the Menstrual Cycle in Women Using Oral Contraceptives



2.) Satisfaction with Current Relationship, Depending on Hormonal Status and Self-perceived Mate Value

Women with Natural Cycles

On the basis of their score on the Mate value inventory, participants were divided into two categories: above average mate value vs. below average mate value (M_{mv} = 5.73, SD = 0.50). ANOVA with phase of the cycle (high EP vs. low EP) and mate value (above average vs. below average) as independent variables, and satisfaction with relationship as a dependent variable showed a significant main effect of mate value ($F(28,1) = 8.11$, $p < .01$), but neither the phase of the cycle ($F(28,1) = 3.02$, $p > .05$), nor the interaction ($F(28,1) = 2.17$, $p > .05$) reached significance. Women with higher mate value were more satisfied with their relationship compared to women with lower mate value (Table 2).

Women Using Oral Contraceptives

ANOVA with the phase of the cycle (high EP vs. low EP) and mate value (above average vs. below average) as independent variables, and satisfaction with

the relationship as a dependent variable showed significant main effects of both mate value ($F(26,1) = 4.62$, $p < .05$), and phase of cycle ($F(26,1) = 6.53$, $p < .05$), while their interaction was not significant ($F(26,1) = 1.06$, $p > .05$). As in the case of women with natural cycles, women with higher mate value were more satisfied with their relationship compared to women with lower mate value. Women using oral contraceptives were less satisfied with their current relationship during high EP phase (Table 2).

Table 2. Mean Ratings of Satisfaction with Current Romantic Relationship, in Women with Different Self-Perceived Mate Value and Different Hormonal Status

	Natural cycle		Oral contraceptives	
	High EP phase	Low EP phase	High EP phase	Low EP phase
Above average mate value	4.6 (0.6)	4.5 (0.5)	4.6 (0.5)	4.8 (0.4)
Below average mate value	4.2 (0.5)	3.3 (0.7)	3.6 (1.1)	4.7 (0.6)

Note: Standard deviations are in brackets

DISCUSSION

In the analysis of attractiveness ratings of male faces, depending on the target face symmetry and the rater's current relationship and hormonal status, the only significant main effect was that of symmetry. Contrary to our expectations and to the majority of findings from previous studies (Thornhill & Gangestad, 1993; Gangestad & Thornhill, 1998; Jones *et al.*, 2001; Koehler, Rhodes & Simmons, 2002), women rated symmetrical faces as less attractive than normal ones. This finding might be an artifact of the methodology used to manipulate the photographs: mirror-technique is rather unsophisticated for these purposes, and although every attempt was made to eliminate peculiarities on the face which would make it look strange after mirroring (e.g. if a model had a mole, scar or any kind of mark on one side of the face, it was removed from the picture to avoid creating an unnatural effect due to the mirroring), the resulting photograph might have still looked odd. The shortcomings of this technique have been discussed earlier (Perrett *et al.*, 1999), and the only way to eliminate them would be use of face morphing software (e.g. Penton-Voak & Perret, 2000), which we were unfortunately unable to obtain. However, there are other possible reasons besides the methodological problems related to face transformation, which could result in preference for asymmetrical target faces. It has been shown that smiles are symmetrical only when posed and that indeed, participants perceive symmetrical smiles as fake and rate mirror-faces as less honest (Kowner, 1996; Wylie & Goodale, 1988). Furthermore, recent findings suggest that symmetry is not a crucial factor in determining attractiveness, as attractive faces are being rated as attractive even when participants can see only one half of the face, and therefore can not

determine whether the face is symmetrical or not (Scheib, Gangestad & Thornhill, 1999). If this is the case, the unnaturalness of the stimuli faces might have outweighed the positive aspects of their symmetrical features. And, finally, some authors argue that associations between fluctuating asymmetry and measures of sexual selection may sometimes be overestimated owing to publication bias and problems associated with small sample size (Palmer, 1999) and that the notion of fluctuating asymmetry as a cue to genetic quality has received less empirical support than has been maintained (Simmons, Tomkins, Kotiaho & Hunt, 1999).

Pair-bonded women from the natural cycle group rated both kinds of stimuli faces as more attractive during high EP, compared to low EP phases of the cycle. Women using oral contraceptives showed a similar pattern: as oral contraceptives simulate the hormonal milieu of pregnancy in the organism, the first three weeks of the oral contraceptive cycle (when pills are taken, and EP levels are higher) are hormonally similar to the mid-luteal phase of the normal cycle, and pregnancy. These results support the hypothesis about hormonal mechanism underlying a shift in attractiveness ratings. Fluctuations in hormonal levels during the natural cycle and fluctuations in hormonal levels during the cycle controlled by oral contraceptives are both followed by shifts in perception of attractiveness of male faces. The different pattern of results for single women from the natural cycle group does not invalidate this notion. In fact, it has been shown previously that women in a relationship tend to show larger cyclic shifts than single women (Fink & Penton-Voak, 2002). This has been interpreted as an adaptive trade-off in mate choice. The circumstances of the mate chooser may affect the priority given to a particular benefit obtained from mate choice (Thornhill & Gangestad, 1999) and shifts in facial masculinity preferences during the fertile phase have been observed when women evaluated men's faces for a short-term relationship (Penton-Voak *et al.*, 1999) and when relationship context was not specified (Johnston *et al.*, 2001; Penton-Voak & Perret, 2000; Penton-Voak *et al.*, 1999). As we did not specify the relationship context, it is feasible to suppose there were variations within the group of single women considering the type of relationship desired or considered, i.e. priorities given to good genes vs. investment indicators.

Previous studies (Johnston *et al.*, 2001; Penton-Voak *et al.*, 1999; Penton-Voak & Perrett, 2000; 2001; Jones, Perrett *et al.*, 2005; DeBruine, Jones & Perrett, 2005) reported selective shifts only for certain preferences (either for symmetry, masculinity, health or self-resemblance). Our results showed generally higher ratings of attractiveness in high EP phases, irrespective of facial symmetry, in the group of women currently in a relationship. One might argue that this shift might be a result of a general improvement in mood during these phases of the cycle. However, results of some studies suggest this is not the case: in women with natural cycles, the mood usually worsens during the luteal phase (Bäckström *et al.*, 1983), and women using oral contraceptives experience less variability in affect across the menstrual cycle than women with natural cycles (Oinonen &

Mazmanian, 2002). Furthermore, hormonally induced cyclic mood changes would affect single women's ratings in the same manner, which was not the case.

If we exclude mood changes as a causal factor of the overall shift towards perceiving all male faces as more attractive during high EP phases, a hormonal mechanism can be postulated, one that makes a woman prone to rate other potential mates as more attractive, and thus, in turn, influence her behavior towards becoming more accessible to other men during certain phases of a menstrual cycle. As already seen, those are the late follicular phase (when conception is most likely) and the mid-luteal phase (hormonally similar to pregnancy). The benefits of copulation with a partner other than a woman's primary mate during the fertile phases of the cycle have already been explained ("good genes" hypothesis; Buss & Schmitt, 1993; Gangestad & Simpson, 2000), and they are especially pronounced in cases when the primary mate shows developmental instability (Gangestad, Thornhill & Garver-Apgar, 2005; Haselton & Gangestad, 2006). But the benefits of mating with multiple partners are not measured only in terms of genetic gains. Besides those indirect benefits, a woman could benefit directly, and, in this case, an adaptive design which would alter her preferences toward specific features would not necessarily occur only during the fertile phases of the cycle. Females of different species frequently obtain material, fecundity-enhancing benefits from multiple mating, which, among others, include increased parental care because more males have a stake in brood paternity, greater access to breeding resources, direct protection from male harassment ("convenience polyandry"), male transfer of nutrients, avoidance of male punishment, lowering the risk of infanticide, formation of social coalitions, or increased likelihood of pregnancy by ensuring fertilization (Jennions & Petrie, 2000). In primate species, it has been hypothesized that uncertainty surrounding paternity could prevent a male from attacking the offspring of a female he had recently mated with. It is speculated that mothers manipulate the information available to males concerning paternity (Blaffer Hrdy, 1999).

The results of our second analysis are in accordance with this idea. ANOVA showed that the effect of hormonal status (high vs. low EP) on satisfaction with relationship was significant only in women using oral contraceptives. They were less satisfied with their partner during the high EP phase, i.e. in the same period when they rated other men's faces as more attractive. It is possible that during this period (hormonally mimicking pregnancy) their expectations from a partner rise (in terms of investment, maybe), making their partners look less adequate. Of course, that is not to say that women are more likely to give up their primary partner. Recent extensive research on 418 long-term couples showed that the correlation between satisfaction with a relationship and its stability (defined as the amount of thoughts and actions related to the actual breaking up of the relationship) in women is relatively low: $r = .56$ (Kamenov, Tadinac, Jelić & Hromatko, in press). In other words, current (dis)satisfaction with the primary partner does not necessarily lead to deserting him; it might merely make other options seem more attractive and appealing than they would be if satisfaction with the primary partner was higher.

The combination of dissatisfaction with a primary partner and increased perceived attractiveness of other men could function as a (hormonally activated) psychological mechanism facilitating displays of sexual accessibility to potential short-term partners. It has been shown that women who exhibited cues of easy sexual access have been rated desirable by men in the context of short-term mating (Schmitt, Couden & Baker, 2001; Schmitt & Schackelford, 2003).

It would seem that the costs of philandering during pregnancy (high EP) are higher: woman stands to lose her primary partner who has already committed himself and is presumably willing to invest in their offspring. However, even though the costs of getting caught are high, so are the potential benefits. As Sarah Blaffer Hrdy argued, the optimal number of fathers is sometimes more than one (1999). Anthropological records of the "partible paternity" system of beliefs in tribes of Amazonia illustrates this view: they believe that fetuses are a composite product of more than one male, and all men with whom a woman had sex are expected to provide food for her child. The anecdotal saying is that as soon as a woman suspects that she is pregnant, she tries to seduce the best hunters and fishermen in the tribe (Blaffer Hrdy, 1999). Even where such a cultural norm does not exist, women use tactics of having multiple mates, and the fact that they use a variety of elaborate and effective ways to deceive their primary partners regarding their extra-pair sexual activity (Schmitt & Schackelford, 2003) might be the best proof for that.

As mentioned earlier, attractiveness of the woman in question might play an important role. Attractive women may secure men of higher mate value as long-term partners, and therefore the trade-off between a mate's genetic quality and paternal investment might be less of an issue (Feinberg *et al.,* 2006). Our results are in line with this notion. ANOVA showed a significant main effect of self-perceived mate value on satisfaction with current romantic relationship that were consistent in women with natural cycles and those using oral contraceptives. Women with high self-perceived mate value were generally more satisfied in their relationships, and their satisfaction showed less variation among groups with different hormonal status (see Table 2). High mate value individuals are the ones that can afford to be choosy: they are probably in a relationship with the partner of their first choice, and therefore would profit less and potentially lose more if they were to pursue another mate. Therefore their satisfaction might reflect the quality of their primary mate (and possibly a psychological mechanism which prevents them from engaging in costly adulterous behavior). This is convergent with findings suggesting that partners of very attractive women "lookout-watch their mates" equally across the menstrual cycle, while partners of less attractive women increase their vigilance only during their mate's fertile periods (Haselton & Gangestad, 2006).

In summary, women found all male target faces more attractive during phases of the menstrual cycle which are characterized by elevated estrogen and progesterone levels, compared to phases characterized by low estrogen and progesterone levels. At the same time, during periods of elevated hormonal levels,

women are less satisfied with their current primary partners, especially in the case of women with low self-perceived mate value, i.e. those whose potential benefits from short-term mating with a secondary partner are greater than potential costs. Taken together, these results support the notion of a plastic, content-specific hormone-mediated adaptive design.

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