

Femininity and Masculinity across the Menstrual Cycle: A relation to Mate Value

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ABSTRACT

Numerous studies have shown that menstrual cycle related variations in sex hormones influence various cognitive processes. These shifts are considered as the evidence for a hormone-mediated adaptive design underlying human mating motivation. In a series of related studies we have shown that (i) femininity does not vary across the menstrual cycle, whereas masculinity is the most pronounced during the fertile period, (ii) masculinity, but not femininity, predicts shifts in spatial cognition across the menstrual cycle, and (iii) women with different positions on masculinity and femininity dimensions differ in their self-perceived mate value. These results suggest that (i) there might be a hormone mediated psychological mechanism making a woman more assertive and dominant during a short time-window when the conception is likely, (ii) menstrual cycle related shifts in cognitive abilities and mating motivation might have a common hormonal mechanism, and (iii) women's mate value (and indirectly her reproductive success) depends upon both feminine and masculine traits.

Key words: menstrual cycle, masculinity, femininity, cognition, mate value

Introduction

Numerous studies have shown that variations in sex hormones across the menstrual cycle influence cognition on various levels: from perception of opposite-sex faces to efficacy in solving cognitive sex-biased tasks¹⁻⁹. Women's preferences for presumed good genes indicators (such as facial and vocal masculinity, and symmetry) tend to be the highest when the likelihood of conception is increased, i.e. in late follicular phase of the menstrual cycle, characterized by the high estrogen level¹⁻⁶. On the other hand, during pregnancy and mid-luteal phase of the menstrual cycle (which is hormonally similar to pregnancy and characterized by high levels of both estrogen and progesterone) their preferences shift toward less masculinized or self-resembling faces, i.e. those indicating prosociality and willingness for investment^{7,8}. These cyclic shifts are regarded as evidence for a hormone-mediated adaptive design underlying human mating motivation¹⁰.

It has also been demonstrated that women's efficacy of solving spatial cognitive tasks (such as mental visualization, and mental rotation) worsens during the phases of the menstrual cycle when the estrogen levels are

higher (late follicular and mid-luteal) compared to other phases of the menstrual cycle¹¹⁻¹⁶. Although these effects of estrogen can be considered as influences of gonadal hormones on non-reproductive behavior (perception and spatial cognition), some authors¹⁷ have suggested otherwise. They postulate an adaptive evolutionary mechanism which reduces female's spatial cognitive abilities and, consequently, mobility during the fertile periods, thus reducing the risk of predation to mothers with newly born offspring and the probability of encounters with males from another group (»fertility and parental care hypothesis«).

While researchers investigating hormone-related shifts in perception of the attractiveness of opposite-sex faces generally agree upon the possible adaptive roles of such shifts, an ongoing debate exists on whether the same holds true for the shifts in cognitive abilities. These shifts might as well be mere byproducts of another mechanism – one regulating the shift toward more feminine patterns of behavior during the fertile phases of the menstrual cycle. Some studies have shown that women around ovulation change their behavior in a manner that en-

hances the chances of attracting a possible mate¹⁸, so that even their facial appearance becomes more attractive¹⁹. But, to our knowledge, there are no published studies regarding the possible menstrual cycle related changes in femininity and masculinity as a personality trait. Given that personality traits are considered relatively stable, especially in the adulthood²⁰, this seems a suitable starting point for testing the »enhanced femininity hypothesis« and determining whether the behavioral changes during menstrual cycle might indeed function as the enhancers of reproductive success.

Furthermore, considering that femininity influences the size of the cycle-related shift in the preferences toward masculinity of male faces¹, we sought to address the issue of whether femininity and masculinity also influence the size of the shift in spatial cognition. This would give reason for a hypothesis about a common hormonal mechanism governing shifts in both mating motivation and cognitive abilities.

Therefore, the aim of the following three related studies was to explore (i) whether masculinity and femininity as personality traits vary during the menstrual cycle; (ii) whether masculinity and femininity predict the cycle-related shifts in efficacy of solving a sex-biased cognitive task; and (iii) the relation among femininity and masculinity as personality characteristics and mate value – a concept developed by evolutionary psychologists to measure one's value on a »partner market«, an indirect predictor of one's reproductive success.

Materials and Methods

One repeated measures study, and two cross-sectional studies were conducted, using *Bem Sex Roles Inventory*²¹ as a measure of masculinity and femininity, *Space Relations Test*²² as a measure of sex-biased cognitive ability to understand spatial relations, and *Mate Value Inventory*²³ as a self-rated measure of one's value on the partner »market«.

Study 1

A total of 66 young (mean age 20.8 years; SD=1.4) healthy women, with regular menstrual cycles and not using oral contraceptives participated in this study (average length of menstrual cycle was 29.11 days; SD=2.01). Based on the menstrual cycle questionnaire, it was determined that at the time of testing 25 women were in the early follicular phase (days 1–7 of cycle) characterized by low estrogen levels; 24 women were in the mid-luteal phase of the cycle (10–3 days before expected menstruation) characterized by high levels of both estrogen and progesterone, and 11 women were in the late follicular phase (up to 3 days before expected ovulation), which is a fertile period of menstrual cycle. Six women were excluded from further analyses because the phase of the cycle could not be determined (they either had irregular cycles or did not meet the criteria to be sorted in any of the phases), so that 60 participants remained.

They all filled out the *Bem Sex Roles Inventory* (BSRI) – an instrument providing independent assessments of masculinity and femininity in terms of the respondent's self-reported possession of socially desirable, stereotypically masculine and feminine personality characteristics²¹. It consists of 60 items describing personality characteristics, 20 of them stereotypically masculine (e.g., ambitious, self-reliant, independent, assertive), 20 feminine (e.g., affectionate, gentle, understanding, sensitive to the needs of others), and 20 neutral (e.g., truthful, happy, conceited). The final score can be expressed either in terms of dimensions (separate scores for masculinity and femininity scales) or as one of the four possible types: masculine, feminine, androgynous, and undifferentiated. The BSRI was modified for the purpose of this study in the way that instead of the question »How often do you behave like that?«, pertaining to every item in the regular version, participants had to answer the question »How often have you behaved like that in the last 5 days?« The answers ranged from 1 (meaning »very rarely«) to 7 (meaning »very often«), and the mean score for each scale was computed.

Study 2

A total of 26 young healthy women (mean age 24.8 years; SD=2.6) with regular menstrual cycles (average length of cycle = 28.1 days; SD=0.4), and not using oral contraceptives were tested twice: once during the early follicular and once during the late follicular phase of the menstrual cycle (two phases with the largest difference in estrogen levels). Participants were tested individually, and the date of each session was scheduled on the basis of the participant's menstrual cycle calendar. The order of sessions was counterbalanced. Four women were excluded from the subsequent analyses, due to the fact that a follow-up showed that one of the testing sessions had been conducted at a wrong time (more precisely, as the »late follicular« phase was operationalized as maximum 3 days before the expected ovulation, all the participants were contacted 2 weeks later to determine whether a new menstrual cycle has begun, and those who reported not having menstrual bleeding 17 days after the test session were excluded).

At each test session participants had to solve the *Space Relations Test*²², which measures the ability to visualize a three-dimensional object from a two-dimensional pattern, and to visualize how this object would look if rotated in space. Each item shows one pattern, followed by five three-dimensional forms. Subjects have to choose all the forms that can be made from the pattern. The test consists of 40 items, maximal score is 100, and participants had 45 minutes to complete it. After the first test session they have also completed the BSRI (regular version).

Study 3

In the Study 3, 101 women filled out the BSRI (regular version) and the *Mate value Inventory*²³ (MVI-7). MVI consists of 17 items – attributes usually considered to be

the 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. Based on the median splits on femininity and masculinity scales of the BSRI, participants were classified in one of four gender-orientation categories: individuals high on both scales as androgynous, individuals with high masculinity and low femininity as masculine, individuals with low masculinity and high femininity as feminine, and those low on both dimensions as undifferentiated.

Results

Study 1

MANOVA showed no differences in femininity scores among different phases of menstrual cycle ($F(2, 57)=0.04$, not significant), while masculinity scores varied significantly ($F(2, 57)=3.42$, $p<0.05$). As can be seen from Figure 1, women scored higher on masculine items during the late follicular (fertile) phase, compared to other phases of the menstrual cycle, which did not differ significantly.

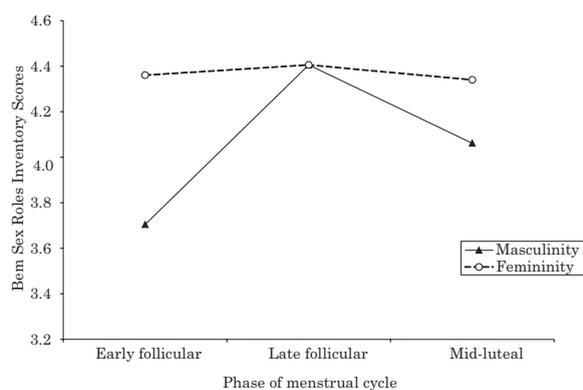


Fig. 1. Masculinity and femininity scores of Bem Sex Roles Inventory across the menstrual cycle.

Study 2

As expected, due to the counterbalanced study design, the order of testing was not significant ($F(1,21)=0.48$, ns). Therefore, the shift in test scores across the menstrual cycle phases was calculated as absolute difference in scores between the two sessions. Pearson's correlations show that women with higher masculinity scores had greater menstrual cycle-related shifts in *Space Relations Test* ($r=0.64$, $p<0.01$; shown in Figure 2), while femininity did not correlate with the amplitude of shift ($r=0.03$, ns).

Study 3

ANOVA with BSRI categories as independent variables, and mate value as the dependent variable showed

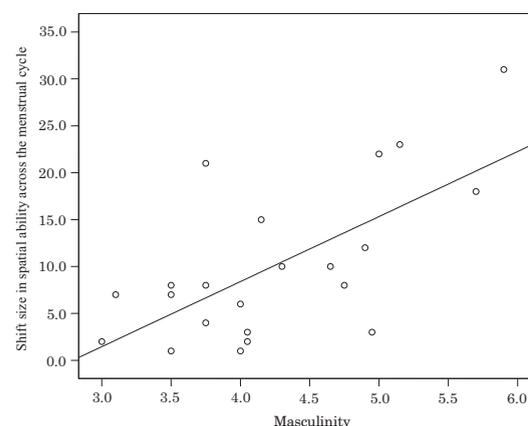


Fig. 2. Correlation between the shift size in scores on *Space relations test* and masculinity dimension of Bem Sex Roles Inventory.

a significant main effect of the BSRI type ($F(95,3)=7.55$; $p<0.001$). As can be seen from Figure 3, individuals in the androgynous group have the highest self-rated mate value, followed by the feminine and masculine group, while the participants from the undifferentiated group have the lowest mate value. Post-hoc Scheffé tests showed no significant difference between the masculine and the feminine group, but they were both significantly lower on mate value than androgynous participants, and significantly higher than undifferentiated ones.

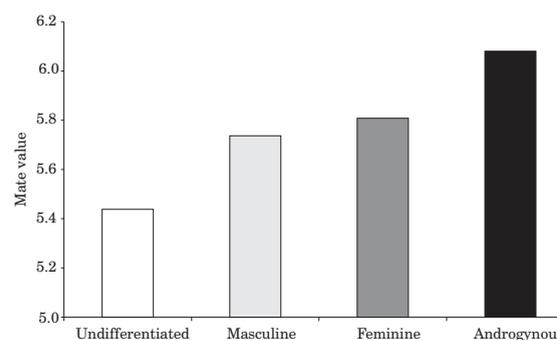


Fig. 3. Self-rated mate value of undifferentiated, masculine, feminine and androgynous participants

Discussion

The results of the Study 1 show that femininity as a trait does not vary across the menstrual cycle, while masculinity does, reaching its highest level of expression during the late follicular, i.e. fertile phase of the cycle. This is not completely in accordance with the »enhanced femininity during fertile period« proposition, although it does add up to some previously reported findings about changes in women's sociosexuality across the cycle. For example, it has been shown that around ovulation women wore more provocative outfits²⁴, reported greater sexual interest in non-primary partners²⁵, were more likely to visit a singles-scene nightclub without a primary mate²⁶,

and to engage in extra-pair sex¹⁸. Also, more masculine women have been shown to have less restricted socio-sexual inventory scores (e.g. they preferred and had more short-term relationships) than feminine women²⁷.

Thus the increase in masculine types of behavior around ovulation might function as an enhancer of proactivity, i.e. of an active pursuit for an available mate. Some examples of items comprised in the masculinity scale are »self-reliant«, »assertive«, »willing to take risks«, »dominant«, and a high score on this scale obviously depicts an action-oriented, assertive, non-inhibited person. A proximal mechanism governing this shift might be the rise in levels of circulating testosterone, which occurs around ovulation²⁸. Consistent with this notion are the findings that women's sexual interest and drive also peak during this period of cycle, when conception is likely²⁹. Furthermore, in studies designed to explore the organizational effects of sex hormones (those which take place prenatally) on the adult sex-role identities, it has been shown that women who were prenatally exposed to higher testosterone and lower estrogen levels scored higher on masculinity dimension³⁰. The pattern of menstrual cycle-related changes in masculinity we have shown here can best be explained in terms of the activational effects of sex hormones, i.e. those induced by fluctuating levels of sex hormones in an adult organism.

Some of the researchers argue that the dimensions of BSRI include a broad range of dimensions, and that masculinity might be more accurately defined in terms of instrumental traits while femininity can be defined in terms of expressive traits³¹. Even so, the finding that the number of displayed instrumental traits increases during a short time-window when the likelihood of conception is increased is consistent with the notion of a hormone mediated adaptive design underlying the human mating behavior.

Taken together, this set of findings suggests that although femininity is a general correlate of physical attractiveness^{32,33}, it does not – at least when it comes to personality traits – become more expressed during the fertile period of the cycle. At the same time, there is an adaptive rise in masculinity, probably governed by the increase in testosterone level, serving as the promoter of proactive and approach behaviors in searching for a mate.

In Study 2 we have found that femininity did not correlate with the shift size in spatial relations scores across the menstrual cycle, but that masculinity did: more masculine women have greater shifts. A similar finding comes from research of attractiveness, where it has been shown that the size of cyclic shifts in preferences toward masculinity of male face was smaller in women with high average levels of estrogen metabolites. This finding has been explained by the fact that feminine and attractive women (those with high levels of estrogen) were most able to obtain investments even from men of higher mate value, and that their cost associated with choosing masculine men as long-term partners was lower, i.e. they were more able to secure masculine men for long-term

partners^{34–36}. Indeed, it has been shown that feminine women, as indicated either by the waist-to-hip ratio³⁷ or by facial femininity³⁸, were more likely to be in long-term relationships than masculine women.

Our finding that similar regularity in shift size exists in the cognitive domain – i.e., that more masculine women show greater menstrual cycle-related shifts in spatial ability, might be put in the same context. In line with the Sherry and Hampson's¹⁷ »fertility and parental care hypothesis«, it could be argued that more masculine women have greater adaptive benefits of a reduced spatial ability during the fertile phases of the cycle. Their high score on masculinity scale indicates their more explorative disposition, tendency to display more risky behaviors and to put themselves more often in potentially risky situations. There is some indirect evidence for this suggestion: more masculine women (as measured by the BSRI) have indeed higher levels of testosterone, and perceive themselves as self-directed, action-oriented and resourceful individuals, while women with lower level of testosterone view themselves as conventional and socialized³⁹.

However, it seems that in the current stage of research on this subject there is simply not enough evidence that anyone, including ancestral women, could have profited from the reduced spatial ability – the benefits of having an evolved spatial cognition are too important to be easily counterbalanced by the potential costs of having a larger mobility radius during the fertile periods. Therefore, it seems that although there are some adaptive benefits of shifting mating preferences throughout the menstrual cycle¹⁰, and of adapting the size of those shifts accordingly to one's own mate value¹, the results showing similar variations in the domain of spatial cognition support only the part of the hypothesis proposing mutual hormonal mechanism underlying both shifts in mating preferences and cognition. Further research is necessary to determine the possible adaptive role of adjusting the size of the shift in spatial cognition in relation to one's position on masculinity dimension.

Finally, in Study 3 we have found that androgynous women have higher self-perceived mate value than both feminine and masculine women, who in turn have higher mate value than undifferentiated ones. The mate value concept can be regarded as an indirect predictor of the reproductive success, considering that individuals with high mate value are the ones most capable of obtaining the desired partner and the ones who can afford to choose^{34–38,40,41}. It has been shown that women with high self-perceived mate value were generally more satisfied in their relationships⁴², probably resulting from the fact that they were with a partner of their first choice, i.e. the one that met their expectations. In line with the notion that human mating strategies are diverse and context-dependent^{34,43}, it can be argued that individuals with higher mate value are the ones that can secure the greatest benefit for their offspring (through both paternal care and good genes) from a long-term partner.

The finding that both masculinity and femininity contribute to mate value is not a surprising one. Studies of mate preferences have shown that both sexes perceived the androgynous members of opposite sex as more desirable for any relationship level (ranging from a date, a one-night sexual encounter, to marriage)⁴⁴. Furthermore, androgynous subjects have often been found psychologically healthier than sex-typed subjects⁴⁵, this obviously being an important aspect of individual's position on the mate »market« (e.g. in the largest cross-cultural study of this type, Buss et al.⁴⁶ showed that the characteristic »emotional stability and maturity« was placed on the third rank of desirable characteristics in a potential mate, across all cultures). Moreover, dominance-related traits like ambitiousness, leadership quality, and strong personality, although traditionally considered as masculine, might increase female mate value as well. Numerous empirical findings suggest there is a complex interplay among biological sex, measures of masculinity and

femininity, sexual behaviors, and other domains of human personality^{30,31,47}.

In summary, the findings that (i) masculinity is the most pronounced during the fertile period, while there are no changes in femininity level across the menstrual cycle, (ii) masculinity predicts shifts in spatial cognitive ability across menstrual cycle, with more masculine women having greater shifts, and (iii) both masculine and feminine traits contribute to mate value, suggest that (i) there might be a hormone mediated evolved psychological mechanism making a woman more assertive and dominant during a short time-window when the conception is likely, (ii) menstrual cycle related shifts in cognitive abilities and mating motivation might have a common hormonal mechanism, and (iii) mate value, as a putative predictor of reproductive success, depends upon the traits that co-vary with hormonal fluctuations (masculinity) as well as those that do not (femininity).

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FEMININOST I MASKULINOST TIJEKOM MENSTRUALNOG CIKLUSA: POVEZANOST S VRIJEDNOŠĆU KAO PARTNERA

S A Ž E T A K

Mnogobrojna su istraživanja pokazala povezanost između varijacija u razini spolnih hormona tijekom menstrualnog ciklusa i različitih kognitivnih procesa. Ove se promjene smatraju dokazom postojanja adaptivnog mehanizma koji se nalazi u podlozi ljudske seksualne motivacije, a kontroliraju ga spolni hormoni. U nizu povezanih istraživanja pokazali smo da (i) se razina maskuliniteta, ali ne i femininosti, u ponašanju mijenja tijekom menstrualnog ciklusa te da je maskulinitet najizraženiji tijekom plodnog razdoblja, (ii) maskulinitet, ali ne i femininost, korelira s veličinom promjene u prostornim kognitivnim sposobnostima tijekom menstrualnog ciklusa, te da (iii) žene s različito izraženom maskulinitetom i femininošću daju različite samoprocjene vlastite vrijednosti na »tržištu« partnera. Ovi rezultati upućuju na zaključak da (i) postoji psihološki mehanizam kojeg kontroliraju spolni hormoni, a uslijed kojeg žena postaje sklonija asertivnom i dominantnom ponašanju tijekom kratkog plodnog razdoblja menstrualnog ciklusa, (ii) postoji zajednički hormonalni mehanizam u podlozi kognitivnih promjena i promjena u spolnoj motivaciji tijekom menstrualnog ciklusa, te (iii) ženina vrijednost na »tržištu« partnera (a posredno i njezin reproduktivni uspjeh) ovisi i o femininim i o maskulinitetnim osobinama.