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Changes in women's interpersonal styles across the menstrual cycle

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ABSTRACT

Past research suggests that women alter their behaviors during periods of high fertility to attract mates. Consistent with this notion, the current research examined the interpersonal style, as defined by the interpersonal circumplex, men tend to find most attractive in potential mates and the change in women's interpersonal styles across the menstrual cycle. In Study 1, a sample of 101 single men reported the interpersonal style they found most attractive in a potential mate. In Study 2, a sample of 86 women reported their interpersonal styles during each day of their menstrual cycle. Results indicated that men tended to prefer mates who were interpersonally warm and that women tended to become more interpersonally warm during periods of high fertility.

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1. Introduction

Women's sexual desires and mate preferences appear to change as a function of fertility status. Normally cycling women tend to report more sexual fantasies and a greater level of sexual desire during the fertile window of the menstrual cycle (Pillsworth, Haselton, & Buss, 2004; Regan, 1996; Stanislaw & Rice, 1988). During this time period, when conception is most likely, it is also expected that women are motivated to behave in a manner that potential mates will find attractive. The current study examined the interpersonal behavioral styles men tend to find most attractive in potential mates and whether or not women alter their interpersonal styles during periods of high fertility consistent with these desires.

Consistent with the notion that women alter their behaviors during periods of high fertility to attract mates, previous research has found that women tend to dress attractively and prefer clothing that is sexy during periods of high fertility (Durante, Li, & Haselton, 2008; Grammer, Renninger, & Fischer, 2004; Haselton, Mortezaie, Pillsworth, Bleske-Rechek, & Frederick, 2007; Schwarz & Hassebrauck, 2008). For example, Haselton and colleagues (2007) invited participants to their laboratory during two different time periods: the high fertility phase and the low fertility phase of the participants' cycles. During their visit, participants were photographed and judges later rated the photographs to determine in which one the women were trying to look most attractive. Results indicated that during high fertility days women were trying to look more attractive by dressing "more fashionably," "nicer," and "showing more skin" than during low fertility days.

One potential explanation for this change in women's dress during high fertility is that women become more intrasexually competitive during this time period. Intrasexual selection is the use of various strategies by members of the same sex in order to gain access to potential mates (Darwin, 1871). Because men vary in their ability to provide desirable qualities and resources, women often compete with each other for desirable mates (Buss & Dedden, 1990). Consistent with this notion, researchers have found that women become more intrasexually competitive during periods of high fertility. Near ovulation, women are more derogating of other women's physical attractiveness and are less likely to share monetary rewards with other women than they are during periods of low fertility (Fisher, 2004). Such shifts in intrasexual competition during ovulation make evolutionary sense given that this period is critical for reproduction. It follows that women's preference for attractive clothing during high fertility is a reflection of an increase in their intrasexual competition (Durante et al., 2008). Women might be dressing "sexier" in order to compete with other women on the mating market.

Given that physical attractiveness is one of the most important characteristics males indicate they desire in potential mates (Buss, 1989) it makes sense that women might compete with each other along this dimension. However, physical attractiveness is not the only characteristic that men use to judge the quality of potential mates. In national and international studies, both men and women desire mates who are kind, intelligent, good companions, considerate, honest, affectionate, dependable, intelligent, understanding, interesting to talk to, and loyal (Buss, 1989; Buss & Barnes, 1986). Individuals also rate their ideal mates as higher than themselves on extraversion, agreeableness, and conscientiousness, and somewhat lower than themselves on neuroticism (Figueredo, Sefcek, & Jones, 2006). It is important to note that although men

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tend to put a greater emphasis on physical attractiveness than women, both men and women rate qualities such as kindness, understanding and affectionate as among the most important characteristics of a potential mate. As suggested by Buss (1989), the species-linked preference for these warm interpersonal qualities might be more important when selecting a mate than the male sex-linked preference of physical attractiveness.

Understanding the link between mate preference and various interpersonal characteristics provides insight into the types of interpersonal behaviors men tend to find most attractive in potential mates and the behavioral styles women might express during periods of high fertility in order to attract potential mates. However, to date, no research has explicitly examined mate preferences using what is arguably the most popular model of interpersonal behavior (Hofsess & Tracey, 2005) – the interpersonal circumplex. The interpersonal circumplex was originally created by researchers at the Kaiser Foundation (Freedman, Leary, Ossorio, & Coffey, 1951; LaForge & Suczek, 1955; Leary, 1957) by systematically observing the interpersonal styles of adults during social interactions. The interpersonal circumplex model presented in Fig. 1 indicates that behaviors or styles can be arranged on two axes: dominance and warmth. On the basis of these two orthogonal dimensions, eight interpersonal styles can be differentiated form one another by greater or lesser degrees of dominance and warmth. The circular ordering of these interpersonal styles presented in Fig. 1 suggests that interpersonal styles that fall close together are more positively related than styles that fall further apart, interpersonal styles at right angles are unrelated, and styles opposite each other are negatively related.

The structure of the interpersonal circumplex presented in Fig. 1 implies that the eight interpersonal octants arranged around the circumplex represent different "blends" of the two dimensions of dominance and warmth. For example, the octant of gregarious-

extraverted is a blend of dominance and warmth; whereas the octant arrogant-calculating is a blend of dominance and hostility (low warmth). In this manner, dominance and warmth can be conceptualized as two bipolar coordinates that can be used to geometrically locate various interpersonal constructs around the cirucmplex. The two-dimensional structure provided by the interpersonal circumplex has been shown to be a valid predictor of a variety of interpersonal constructs (e.g., Ansell, Kurtz, & Markey, 2008; Horowitz, 1996; Madison, 1997; Markey, Funder, & Ozer, 2003; Markey & Kurtz, 2006; Markey & Markey, 2007; Pincus & Wilson, 2001; Sadler & Woody, 2003; Tracey, 2004; Trobst, Ayearst, & Salekin, 2004).

The current study has two primary aims. First, the interpersonal circumplex will be used in order to determine the interpersonal style single men tend to prefer in potential mates. Several of the characteristics men tend to prefer in potential mates can be easily mapped onto the interpersonal circumplex. Specifically, the characteristics of kindness, consideration, affection, dependability, understanding, extraversion, and agreeableness all suggest that males will generally prefer mates who are located on the right hand side of the interpersonal circumplex near the warm-agreeable (LM) octant (Markey & Markey, 2006; McCrae & Costa, 1989; Wiggins & Broughton, 1991). This finding would indicate that men tend to prefer women who are interpersonally warm but only moderately interpersonally dominant. Second, changes in women's interpersonal styles will be examined across the menstrual cycle. Previous research suggests that women alter their behaviors during periods of high fertility to match the desires of men (Durante et al., 2008; Grammer et al., 2004; Haselton et al., 2007). Consistent with this notion, it is expected that women will express interpersonal behaviors during periods of high fertility that are consistent with men's desires for potential mates, as determined by Study 1. Specifically, it is expected that women who
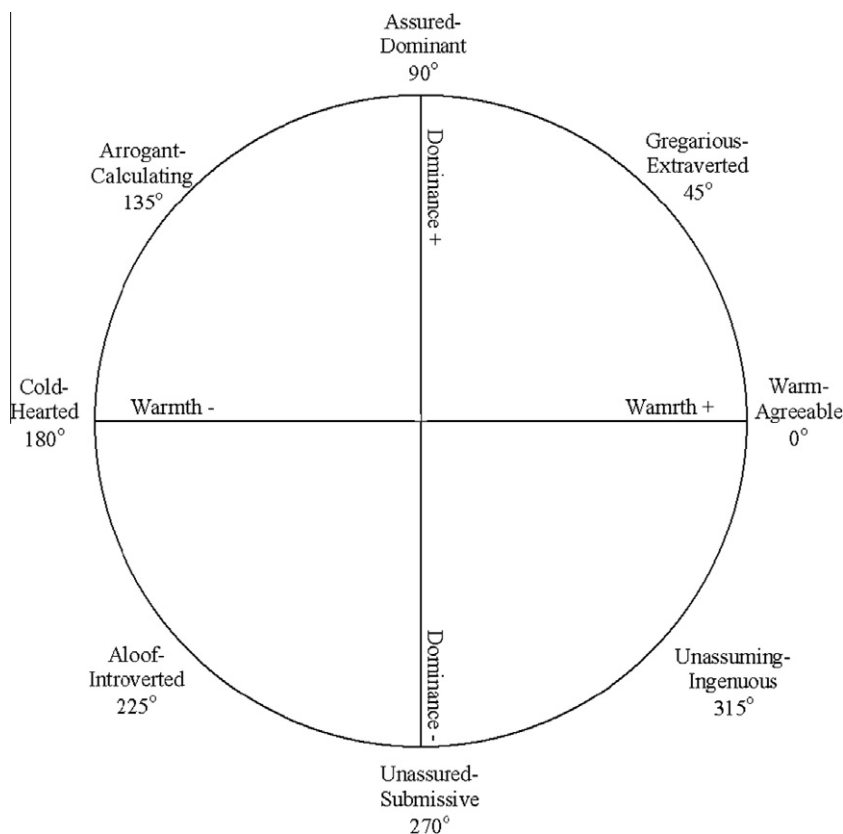

Fig. 1. The Interpersonal Circumplex.

are cycling normally will become more interpersonally warm during periods of high fertility but will express little change in their interpersonal dominance during this period.

2. Study 1: preferred interpersonal styles of men's ideal mates

2.1. Method

2.1.1. Participants

To examine the interpersonal style men tend to prefer in potential mates, data were collected from 101 men (average age = 19.01; SD = 1.01). Participants were recruited through advertisements placed around a Northeastern University campus indicating that researchers were seeking participants who were single and currently interested in finding a romantic partner.

2.1.2. Measures and procedure

In order to describe the interpersonal style of one's ideal mate, participants completed the Interpersonal Adjective Scale (Wiggins, 1995). The Interpersonal Adjective Scale consists of 64 adjective items designed to assess the eight octants of the interpersonal circumplex. In the current study, participants indicated how accurately each adjective described his ideal mate using a scale of 1–8, with 1 indicating an *extremely inaccurate* description and 8 an *extremely accurate* description. Past research shows strong support for the circumplex structure of the octant scales (e.g., Gurtman & Pincus, 2000; Wiggins, 2003; Wiggins & Broughton, 1991; Wiggins, Trapnell, & Phillips, 1988) and the validity of these scales as assessments of interpersonal octants (e.g., Wiggins & Broughton, 1991; Wiggins & Trobst, 1997). For this study, the internal consistency estimates for each octant were .83 for assured-dominant, .85 for arrogant-calculating, .85 for cold-hearted, .87 for aloof-introverted, .84 for unassured-submissive, .79 for unassuming-ingenuous, .87 for warm-agreeable, and .87 for gregarious-extraverted.

3. Results

Fig. 2 displays the mean mate preference for each octant of the interpersonal circumplex. As can be seen, participants rated the warm-agreeable octant as the most desirable and the cold-hearted octant as the least desirable. In order to better define the desired interpersonal profile of males' ideal mate, the data were analyzed using the structural summary method (Gurtman, 1994; Gurtman & Balakrishnan, 1998; Gurtman & Pincus, 2003; Wright, Pincus, Conroy, & Hilsenroth, 2009). This methodology recognizes that, given the circumplex structure of the Interpersonal Adjective Scale, the pattern of mean scores presented in Fig. 2 should exhibit a sinusoidal pattern. The pattern of a sinusoidal curve can be summarized using the formula (Wright et al., 2009):

$$M_i = e + a \times \cos(\theta_i - \delta) + d$$

where M_i is the expected mean score for octant i, e is the elevation of the curve, a is the amplitude, θ_i is the angular location of octant i, δ is the angular displacement of the curve, and d is a deviation component.

The elevation of the curve simply represents the mean response level across scales. In the current study, this is merely a function of response style and not interpersonally meaningful. Amplitude represents the degree of differentiation of the profile and is a measure of the structural patterning of the profile. An amplitude of zero indicates that the scores are identical on all the octants (i.e., the curve is flat), whereas a large amplitude indicates that the curve has a single peak and trough. The angular displacement of the curve represents the angular location on the curve where it peaks. In the context of the current study, this would indicate the mean angular location on the circumplex where males tended to locate their ideal mates. Finally, deviation is used to compute a goodness of fit statistic, which reflects the degree to which the profile in Fig. 2 conforms to a sinusoidal curve. Least square estimates for these values were computed using the Circumplex Group Data
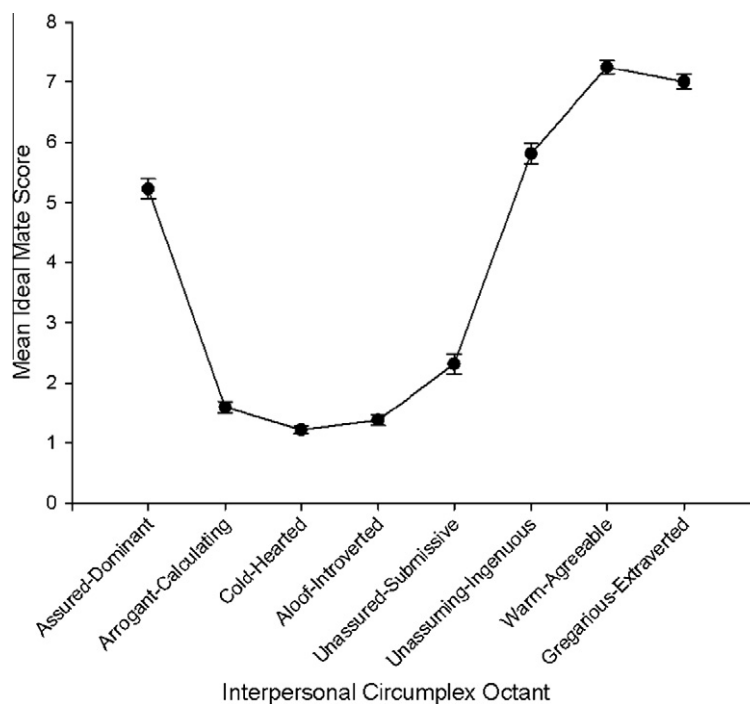
Fig. 2. Male's mean ideal mate score for each octant of the interpersonal circumplex (error bars represent 95% confidence interval). Note: assured-dominant *M* = 5.22, SD = .82; arrogant-calculating *M* = 1.60, SD = .51; cold-hearted *M* = 1.21, SD = .32; aloof-introverted *M* = 1.37, SD = .46; unassured-submissive *M* = 2.31, SD = .86; unassuming-ingenuous *M* = 5.80, SD = .86; warm-agreeable *M* = 7.24, SD = .60; gregarious-extraverted *M* = 6.99, SD = .63.

Calculator (Wright et al., 2009). The model's structural parameters were as follows: $e = 3.96$, $a = 3.39$, $\delta = 16°$, $R^2 = .97$.

The large R^2 value indicates that the means presented in Fig. 2 are adequately summarized by their structural components (i.e., e, a, and δ). The amplitude suggests this profile is differentiated, therefore provides strong interpersonal information. Most importantly, the angular displacement (16°) indicates that, on average, males tended to locate their ideal mates in the warm-agreeable octant of the interpersonal circumplex. Additionally, by summing the evaluation (3.96) and amplitude (3.39) the height of the curve at 16° is estimated to be 7.35 (i.e. close to the maximum level of 8.0 on the Interpersonal Adjective Scale.

4. Study 2: changes in women's interpersonal styles across the menstrual cycle

4.1. Method

4.2.1. Participants

To examine the changes in women's interpersonal styles across the ovulation cycle, data were collected from 86 women (average age = 18.62; SD = .84). Of these participants, 48 were normally cycling and 38 were currently using hormonal contraceptives. Participants were recruited through the subject pool at a Northeastern University and given course credit for their participation.

4.2.2. Measures and procedure

In groups of 2–6, participants first completed a brief demographic form, provided information about their menstrual cycle characteristics, and indicated whether or not they were using hormonal contraceptives. On average, women in the study reported having fairly regular cycles (M = 28.45 days; SD = 1.79 days). Each participant was then provided a unique ID number. Participants were asked to use their ID number to log into an internet web site every night for 31 nights. Each night, participants reported whether or not they began or ceased menstruating. Additionally, each night participants described how they tended to behave during the day by completing the warm-agreeable, cold-hearted, assured-dominant, and unassured-submissive subscales of the Interpersonal Adjective Scale (i.e., a total of 32 items). In the current study, participants indicated how accurately each adjective

described how they acted around other individuals during the day using a scale of 1–8, with 1 indicating an *extremely inaccurate* description of how the participant behaved and 8 an *extremely accurate* description of how the participant behaved. The mean internal consistency of the four octant scales across time was high for the warm-agreeable (M α = .92), cold-hearted (M α = .88), assured-dominant (M α = .84), and unassured-submissive (M α = .87) octants. Standardized octant scores were then averaged together in order to compute participants' daily warmth (warm-agreeable and reversed cold-hearted octant scores) and dominance (assured-dominant and reversed unassured-submissive octant scores) scores. Using this methodology, participants reported an average of 30.26 daily reports of interpersonal warmth and dominance resulting in a total of 2603 different daily reports of interpersonal behaviors provided by 86 participants.

5. Results

Preliminary analyses indicated that women who were using hormonal contraceptives and women who were not using hormonal contraceptives did not significantly differ from each other in terms of the average amount of warmth (Ms. = −.02 and .10, respectively; SDs = .78 and .73, respectively; t (84) = 1.67, p = .25) or dominance (Ms. = .10 and −.07, respectively; SDs = .67 and .76, respectively; t (84) = .79, p = .43) reported across their menstrual cycles. More central to the primary aims of the study, multilevel modeling was utilized in order to examine potential changes in warmth and dominance that occur during changes in fertility. Actuarial data provided by Wilcox, Dunson, Weinberg, Trussell, and Baird (2001) suggest that fertility (likelihood of conception from having sexual intercourse one time) is at its highest during day 12 of an average menstrual cycle (p of conception = .094) and decreases as one moves further from this day (see the X-axis of Fig. 3). Based upon these data, participants' fertility was estimated each day they completed the study. Therefore, daily reports of dominance or warmth (nested within participants) were Level 1 units of analysis, and participants were level 2 units of analysis. Accordingly, fertility was a level 1 factor and contraception use (0 = contraception is used; 1 = contraception is not used) was a level 2 factor. Using this coding scheme, the main effect of fertility represents the relationship between fertility and daily styles for
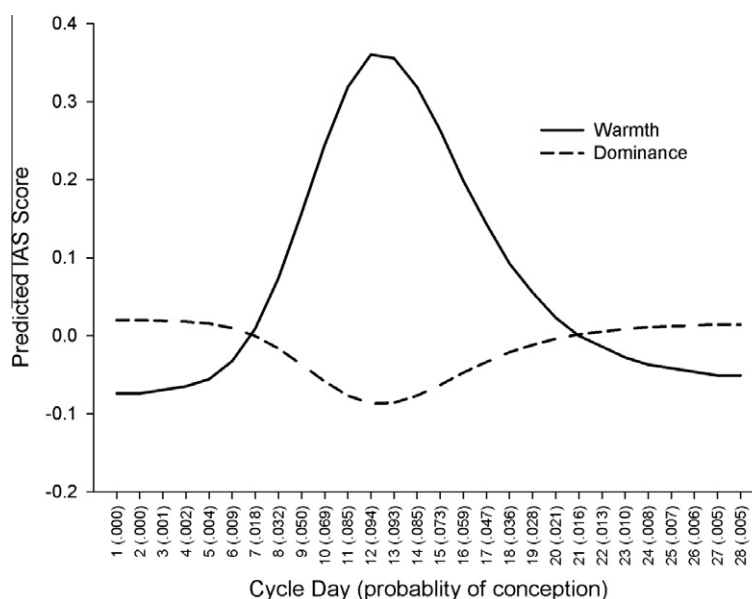

Fig. 3. A graphic representation of the multilevel model equations predicting daily reports of dominance and warmth from daily fertility status for women cycling normally.
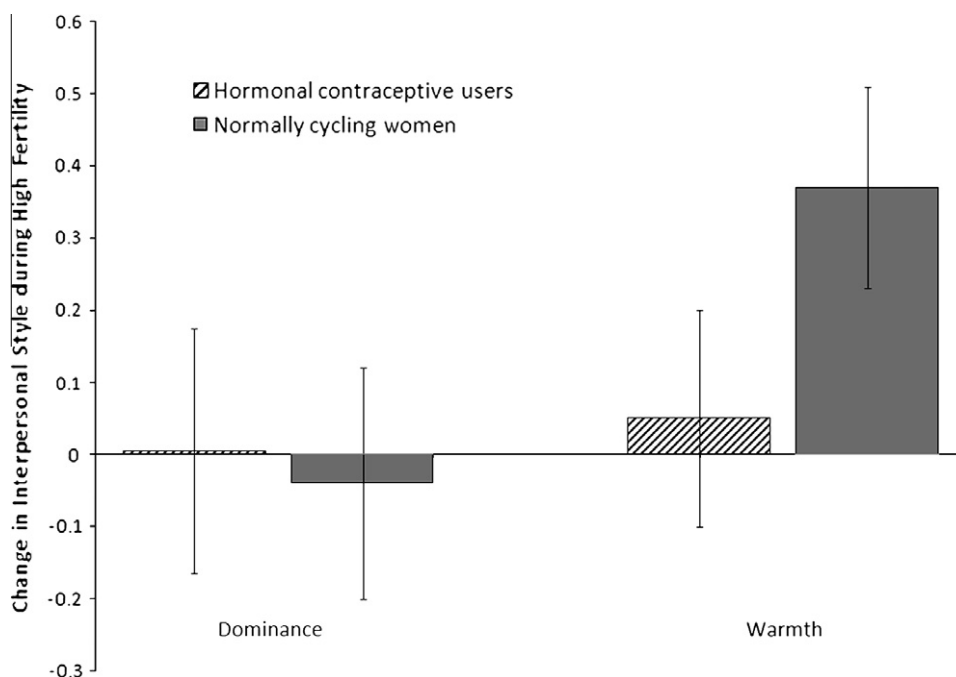
Fig. 4. Estimated mean change in women's dominance and warmth interpersonal styles during periods of high fertility for women using hormonal contraceptives and women cycling normally.

women using hormonal contraception. The cross level interaction (fertility × contraception use) indicates whether or not this effect is different for women cycling normally versus those using hormonal contraceptives.

Results indicated that fertility was unrelated to interpersonal dominance (t (2600) = −.07, p = .94) for participants using hormonal contraceptives. Additionally, the cross-level interaction between fertility and contraception use revealed that this effect was not significantly different for individuals not using hormonal contraceptives (t (2600) = −1.12, p = .26). Results also indicated that fertility was unrelated to interpersonal warmth (t (2600) = 1.67, p = .10) for participants using hormonal contraceptives. However, the cross-level interaction between fertility and contraception use revealed that this effect was significantly increased if participants were cycling normally (t (2600) = 3.80, p < .01). Using these equations, Fig. 3 displays the predicted daily dominance and warmth scores for women cycling normally based on their fertility on a given day. This figure helps demonstrate that although normally cycling women's dominance changed very little during periods of high fertility their warmth tended to increase during this same period.

Other researchers have noted the importance of examining various phases of the menstrual cycle because of expected menstrual side effects (e.g., bloating, irritability, etc.) that might alter women's' interpersonal behaviors (Gueguen, 2009; Haselton & Gangestad, 2006; Miller, Tybur, & Jordan, 2007). Therefore, two sets of scores were created for each participant representing average scores during the ovulatory (when fertility is at its highest) and luteal (when fertility is at its lowest) phases of the menstrual cycle excluding premenstrual and menstrual days. Comparing these phases reduces the likelihood that the changes observed in women's interpersonal styles during periods of high fertility simply occurred due to premenstrual and menstrual side effects. As done in previous research (c.f., Gueguen, 2009; Haselton & Gangestad, 2006; Miller et al., 2007), for a 28-day cycle, the current study defined high fertile days as including days 11–15 and low fertile days included days 18–25. Mean differences in warmth and

dominance between women using hormonal contraceptives and women cycling normally during periods of high fertility were examined using ANCOVAs with low fertility day warmth and dominance serving as covariates. Findings using this methodology were virtually identical to results using multiple regression to examine regressed change (Cohen, Cohen, Aiken, & West, 2003). As shown in Fig. 4, the change in dominance during periods of high fertility was not significantly different for women using hormonal contraceptives and women cycling normally (F (1, 83) = .15, p = .70; Partial η^2 = .00). However, consistent with the predictions and the earlier multilevel modeling analysis, women who were cycling normally tended to have a greater increase in their interpersonal warmth during periods of high fertility than women using hormonal contraceptives (F (1, 83) = 9.53, p < .01; Partial η^2 = .10).

6. Discussion

Past research has documented that women's sexual desires and mate preferences tend to change across the menstrual cycle (Pillsworth et al., 2004; Regan, 1996; Stanislaw & Rice, 1988) in a manner that increases the likelihood of reproduction. Similarly, women tend to alter their physical appearance in a number of ways making themselves more attractive to potential mating partners during periods of high fertility (Durante et al., 2008; Grammer et al., 2004; Haselton et al., 2007; Schwarz & Hassebrauck, 2008). The current study attempted to build upon this research by examining women's interpersonal styles across the menstrual cycle. Specifically, the interpersonal circumplex was used to examine both the interpersonal styles men tend to desire in a romantic partner and whether or not women exhibit these interpersonal characteristics during periods of high fertility.

Results from the first study suggested that men were most attracted to mates who behave in an interpersonally warm manner. On average, men tended to locate their ideal mates' interpersonal style at 16° on the interpersonal circumplex (within the warm-agreeable octant). In other words, men's ideal mates tended to

act in a kind, sympathetic, accommodating, and gentle manner (Wiggins, 1995). This is not entirely surprising, given previous research suggesting both men and women tend to prefer mates who possess the characteristics of kindness, consideration, affection, dependability, understanding, extraversion, and agreeableness (Buss, 1989; Buss & Barnes, 1986).

In order to examine how women's behavioral styles change during periods of high versus low fertility, the interpersonal styles of women were assessed each day of their menstrual cycle. As expected, it was found that women who were normally cycling (i.e., not using hormonal contraceptives) exhibited greater changes in their interpersonal warmth when they were at their fertility peak than during other phases of the menstrual cycle and than women using hormonal contraceptives. By applying a simple geometric formula (see Wiggins & Broughton, 1991; Wright et al., 2009) to the mean changes in warmth (M change = .37; see Fig. 4) and dominance (M change = −.04; see Fig. 4) during periods of high fertility, the exact angular location of this change is computed to occur at 354° on the interpersonal circumplex (the warm-agreeable octant[1]). In other words, during the window of high fertility women tend to become more interpersonally warm and are more likely to act in a kind, sympathetic, and gentle manner than during periods of low fertility.

Examining the findings of these two studies together suggests substantial overlap between the interpersonal qualities men prefer in mates and women's interpersonal styles during periods of high fertility. Men tend to prefer a mate who has a warm interpersonal style (located in the warm-agreeable octant) and when women are most fertile they tend to manifest interpersonal styles that are warm (located in the warm-agreeable octant). In fact, the angular difference on the interpersonal circumplex between what men desire in a potential mate (16°) and how women's interpersonal styles changed during periods of high fertility (354°) is only 22°. To illustrate the similarity between these two locations on the circumplex in terms familiar to most researchers, two variables that are perfectly assessed by the interpersonal circumplex, which are separated by only 22° would be correlated with each other .92 (this is computed by taking the cosine of the angular difference; Markey & Markey, 2006; Wiggins & Broughton, 1991). Taken together, these findings are consistent with the notion that women alter their interpersonal styles during periods of high fertility to match the desires of men (Durante et al., 2008; Grammer et al., 2004; Haselton et al., 2007) and possibly in order to compete with other women for access to potential mates. Just as women might dress "sexier" during periods of high fertility, women might also act in an interpersonally warm manner during this time period in order to compete with other women on the mating market.

Findings from the current study and past research examining links between ovulation and outcomes including sexual desires, sexual fantasies, and dress (e.g., Durante et al., 2008; Grammer et al., 2004; Haselton et al., 2007; Pillsworth et al., 2004; Regan, 1996; Schwarz & Hassebrauck, 2008; Stanislaw & Rice, 1988) seem to suggest that women respond to varying levels of hormones associated with ovulation, which seem to alter their social interactions and desires. What is still unknown from this research is the exact hormonal mechanism that might be responsible for these results. Past researchers have suggested that the hormones luteinizing, testosterone, and progesterone might be responsible for some of the changes observed in women's behavior across the menstrual cycle (DeBruine, Jones, & Perrett, 2005; Gangestad, Thornhill, & Garver, 2002; Haselton & Gangestad, 2006; Puts, 2005). Future researchers might consider directly examining these specific hormones in

order to gain insight into the exact hormonal mechanism that is responsible for these observed shifts in women's social interactions and desires during the menstrual cycle.

To our knowledge, this is the first study to examine the patterns in women's interpersonal qualities across the menstrual cycle and to relate these patterns to men's desired preferences in a mate. However, the findings from this study should be tempered with an understanding of its limitations. Due to the longitudinal nature of this study (i.e., daily reports across 31 days), the sample of women who participated was modest. Adequate power was available to detect significant results, but larger samples should be employed to replicate these findings. Participants' sexual orientation was not examined in the current study. It would be interesting for researchers to examine whether or not these results replicate among a sample of lesbian women. The methodology employed also limited the surveys used in this study to those that were relatively short and quick to complete. An examination of the entire Interpersonal Adjective Scale and related measures across women's menstrual cycle would extend this research. Finally, women provided information about the average length of their menstrual cycles and then reported each day whether or not they were menstruating. This allowed for the probability of conception on a given day (i.e., fertility) to be estimated. However, environmental factors such as stress, travel and even sleep patterns may alter women's menstrual cycles and make ovulation less than completely predictable. Ideally, future research could identify women's high fertile days through repeated use of urine or blood ovulatory tests across women's menstrual cycle.

In conclusion, the research presented in this report suggests that women's ovulatory phase is associated with interpersonal behaviors that increase the chances of attracting potential mates during periods of high fertility. Similar to other tenants of evolutionary theory, our research does not necessarily suggest that women are deliberately or consciously behaving in a manner that increases their odds of mating. Although it might be argued that women's warm behaviors are socially reinforced and thus self-sustaining (Eagly & Wood, 1999), a social learning explanation for our findings does not explain why warmth would peak during specific days of the menstrual cycle. Instead, hormonal fluctuations that accompany the phases of women's menstrual cycle appear to increase the odds women will attract potential mates during the peak of their fertility. It seems likely that other behavioral patterns that have yet to be examined may accompany women's hormonal fluctuations and contribute to reproduction; determining what these are remains the work of future research.

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[1] The exact formula used to compute the angular location of change was: angular location of change = arctangent (M change dominance/M change warmth) or 354° = arctangent (−.04/.37).

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