A GOOD MATE INSPIRES LOYALTY; RELATIONSHIP QUALITY MODERATES AN OVULATORY PHASE SHIFT IN ROMANTIC RELATIONSHIP FEELINGS

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A GOOD MATE INSPIRES LOYALTY;
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Running head: OVULATORY SHIFTS IN RELATIONSHIP FEELINGS

A Good Mate inspires Loyalty;
Relationship Quality moderates an Ovulatory Phase shift
in Romantic Relationship Feelings

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Abstract

Theory and evidence are presented that support the hypothesis that being in a high quality romantic relationship protects women from ovulatory phase increases in negative relationship emotions that may shift their interest toward extra pair men. Relationship status, physical abuse, contribution of resources, satisfaction/commitment, and partner attractiveness were reported by a mixed race community sample of 353 women in a between-subjects design. Fertile women in low quality relationships (e.g., less committed, more abusive) showed more negative, conflicted, and ambivalent as well as less positive relationship feelings relative to both fertile women in high quality relationships and to non-fertile women. Supplementary analysis showed partner attractiveness (PA) was uncorrelated with relationship quality (RQ), and PA also moderated the ovulatory shift such that fertile women paired with attractive men felt better about their relationships than did all other women. Three way interactions (Fertility X RQ X PA) confirmed that RQ and PA are not only distinct components of mate quality but that they also moderate the influence of ovulatory shifts on relationship feelings. Implications for the theories of dual sexuality (Thornhill, 2006) and strategic pluralism (Gangestad & Simpson, 2000) are discussed.

A Good Mate inspires Loyalty; Relationship Quality buffers against an Ovulatory Phase increase in Negative feelings about Romantic Partners

Introduction

Are women predisposed to cuckold an unattractive mate? Evolutionary models of female sexuality have argued this possibility on the basis of evidence that women prefer "attractive" male attributes during the phase of their menstrual cycles when they are fertile relative to the rest of their cycle (Thornhill, 2006). A pre-ovulatory shift in sexuality and preferred male attributes (Gangestad & Cousins, 2001; Simpson & Lapaglia, 2006) is thought to focus women on the physical attractiveness (a presumed indicator of genetic quality) of a partner during times of high conception risk, in contrast to a focus on the pair-bonding qualities of a partner during the non-fertile phase (Gangestad, Garver-Apgar, Simpson, and Cousins, 2007). However, both theory and empirical research have focused primarily on physical attributes of the male partner, and they typically exclude pair-bonded women (e.g., Gangestad, Simpson, Cousins, Garver-Apgar, & Christensen, 2004) and ignore the pair-bonding attributes of the male partner. In the only study of ovulatory shifts in relationship functioning, Haselton and Gangestad (2006) tracked 25 pair-bonded women across one menstrual cycle (35 daily reports) and found that women who valued their partner's attractiveness over his relationship investment reported less extra pair interest and less partner jealousy at fertility relative to other cycle times. Although this finding is consistent with the hypothesis that women are focused on partner attractiveness at fertility and provides evidence that partner attractiveness moderates an ovulatory shift in extra pair interest, the quality of the relationship was not tested. Indexing relationship quality and partner attractiveness as

opposite poles not only fails to distinguish partners who are both attractive *and* good pair bonders from partners who are only one or the other, but it prevents examination of the relative contributions of relationship quality and partner attractiveness to ovulatory shifts in experience. In this paper we argue that given the importance of male parental investment to women's reproductive success (Geary, 2000; Geary & Flinn, 2001), the quality of pair bonds must be taken into account in theoretical models and empirical studies of fertility. We therefore argue that ovulatory shifts that focus women's interest on attractive extra pair men at fertility should be stronger among women with low quality pair bonds.

Thus, we begin with a discussion of theoretical models of human reproduction and argue that the quality of a pair bond is an overlooked element of those models (Geary, 2000). Next, we outline an empirical test of the idea that the quality of a pair bond moderates ovulatory shifts in both explicit relationship feelings and implicit emotions which could buffer women from ovulatory increases in negative relationship feelings. The latter are thought to accompany the ovulatory focus on attractiveness of the mate and extra pair mates (Gangestad & Simpson, 2000). We find preliminary evidence to support our model, but also conclude that more research focused on relationship quality in women in long term pair bonds is needed in order to answer questions about the nature of ovulatory shifts in female sexuality.

The function of ovulatory shifts and the importance of pair bonding

Human fertility was long thought to be *concealed*, but we now think of ovulation as merely *covert* (Powlowski, 1999; Havlicek, Dvorakova, Bartos, & Flegr, 2006), because women experience a host of subtle pre-ovulatory (fertile phase) shifts in

sexuality and cognition relative to non-fertile cycle phases. As mentioned, empirical studies support the theory that these shifts function to focus women on pair-bonding during non-fertile phases and on mating during fertility (Thornhill, 2006). A typical focus on pair-bonding is consistent with evidence that male parental investment increases the probability that human offspring will survive and thrive (Geary & Flinn, 2001). However, the ovulatory shift theoretically occurs because a pair-bonded mate may not have the "best" genes available to a given woman, where "best" is defined by enhanced (relative to her current mate) prosperity of the offspring (Williams, 1992). And, given the high cost of each conception for women - including a burdensome pregnancy, significant chance of mortality during childbirth, and a prolonged period of expensive provisioning - women theoretically seek not only the "best" genes for each pregnancy, but also a stable rearing situation (i.e., a committed relationship; Hrdy, 1999). At the same time, pair-bonded males are typically vigilant against cuckoldry (Geary, 2000), making it costly to the pair bond for women to seek extra-pair mating (Bellis & Baker, 1990). One way a woman can reduce these costs is to engage in extra pair mating only when there is a high probability of conception – that is, when the woman is in the fertile phase of her cycle. Consistent with this, infidelity rates are higher when women are fertile (Bellis & Baker, 1990).

Following the introduction of this theoretical perspective, a great deal of research has focused on ovulatory shifts in the attributes women prefer in romantic partners, and more recent research has distinguished between preferences for long term mates vs. short term mates. Although some women engage in short-term mating hoping to extend the liaison into a long-term bond (Regan & Dreyer, 1998) or for material gain (Vigil, et al.,

2006), the primary function of short-term mating (for women) is theoretically access to high quality genes (Thornhill, 2006; cf. Hrdy, 2003). Thus, attributes that women prefer in short term mates are correlated with high immune functioning and social success or dominance (Gangestad et al, 2007), which are in turn correlated with human reproductive success (Alexander, 2004). In contrast, women emphasize their preferences for stability, amiability, loyalty, and material success in long-term mates (Buss & Barnes, 1986). In light of these disparate preferences, current theoretical models of mating argue that because women prefer males that display dominance and social success at fertility, women are adapted to cuckold long term mates that do not have attractive attributes with more attractive and dominant males during their fertile phase (e.g., strategic pluralism, Gangestad & Simpson, 2000). In other species, this tendency to cuckold is contingent on mate quality (Møller & Tegelström, 1997).

Interestingly, although women value male attractiveness, the most attractive men may not make the best pair bonding partners. Male fitness display is thought to increase with androgen (e.g. testosterone) levels (because only males in good condition can tolerate high testosterone levels; Geary, 2005), and male attractiveness is strongly linked to physical markers of high androgen levels (Grammer et al., 2003; Gangestad & Thornhill, 2003; Dabbs & Mallinger, 1999; etc.). Male attractiveness is also linked to economic success (Mulford, Orbell, Shatto, & Stockard; 1998), suggesting that attractive men have more potential resources to contribute to a family. But high androgen levels are also correlated with elevated reactive aggression (Benderlioglu et al., 2004), higher dominance (Perrett et al., 1998; Mazur & Booth, 1998), and lower paternal and spousal investment behaviors (Fink & Penton-Voak, 2002; Gangestad & Simpson, 2000; Gray et

al, 2002; Puts, 2005). Those correlations suggest that males with high androgen levels (which are strongly linked to physical attractiveness) may be less able to maintain stable pair bonds and be less generous in contributing resources toward offspring relative to their lower androgen counterparts. This in turn implies that male attractiveness is valuable to women because attractiveness is heritable and correlates with reproductive success, and not because attractive men make especially good mates.

Good pair bonding protects against cuckoldry

To the extent that high pair-bonding ability correlates with reproductive success and is heritable, it should be valued in the same way that physical attractiveness is valued by women (Williams, 1992). Given that the majority of children born to pair-bonded women are in fact sired by their mother's pair-bonded mate (about 90% according to Geary, Vigil, & Bird-Craven, 2004), males who pair bond are typically reproductively successful. Furthermore, there is indirect evidence that males who form high quality pair bonds may not experience the same rate of unfaithfulness as men who form poor pair bonds. Women who feel satisfied and committed to their relationships are less likely to be unfaithful than those who feel less satisfied (Drigotas, Safstrom, & Gentilia, 1999), and women are more likely to feel satisfied and committed if they are in relationships that are stable, low in conflict, and high in communication (Rusbult, Drigotis, & Verette, 1994). Males who form pair bonds with these qualities therefore experience lower rates of infidelity than those who bond poorly because the high cost of risking the investment of such a high quality mate reduces the payoff of infidelity.

The idea that traits such as attractiveness and social success in offspring may not be worth the cost of infidelity to women who are paired with good pair-bonding mates

implies that women paired with good mates should not be inclined to seek extra pair mating when they are fertile, because it would not increase their offspring's fitness potential. So if the function of ovulatory shifts is to focus women on high quality mating opportunities, then women who are paired with good pair bonders may not experience detectable fertility shifts in mate preferences, or they may experience weaker or different ovulatory shifts than unpaired or poorly-paired women. And because pair bonding qualities should be valued as highly as physical attractiveness or high social status, then being paired with a good pair bonder could arguably be no different than being paired with a popular-good-looker in that women should not be tempted toward infidelity at fertility in either case.

Identifying partners with good pair-bonding qualities

To the extent that pair bonding ability is valued, women would face the adaptive problem of identifying men who have high quality pair-bonding traits (Andrews, Gangestad, & Matthews, 2002), which is analogous to the problem of identifying men with high physical genetic fitness. But in contrast to highly visible markers of attractiveness and social success or dominance, attributes that mark high long term mate value (like loyalty and investment) are probably more subtly displayed, partly because being a good long-term mate requires an extended period of commitment and generosity. For example, a "great" long-term mate may be revealed as a dud only when he deserts his family. This implies that the adaptive problem women have in identifying a male with good long-term-mating-fitness is markedly different than the task of identifying a male displaying high physical or social fitness, although the cognitive processes may or may not be analogous. In other words, just as women "feel" physically attracted to a mate,

they probably also "feel" satisfaction with a mate and a relationship. Thus we theorize that one of the best markers of a good long term mate may be a woman's ongoing overall satisfaction with the relationship.

The notion that relationship satisfaction serves as an ongoing indicator of the pair-bonding quality of a mate is consistent with the strong link between satisfaction and numerous markers of relationship functioning (Rusbult et al., 2004). For example, satisfaction is strongly associated with relationship stability (Karney & Bradbury, 2000) And as previously mentioned, satisfaction has been shown to protect a marriage against infidelity (Previti & Amato, 2004). These research findings are consistent with the idea that satisfaction with a relationship provides cues about the pair bonding quality of the mate.

If women are identifying good-pair bonders via their satisfaction with their relationship, then it follows that women who are happy about and feel satisfied with their relationships may not gain a reproductive advantage by seeking extra pair sex, because of the high cost of risking a good quality relationship and parental investment. By extension, women in high quality relationships would find it too costly to endanger their pair bond with infidelity, regardless of the relative physical or social desirability of their mate vs. an extra pair mate. This implies that women who feel satisfied with their relationships should not experience the fertility changes that shift their sexual interest away from their mates relative to women who are unhappily paired, or at least not to the same extent.

It should be noted that positive relationship feelings may change quickly and dramatically if, for example, a woman discovers infidelity in her mate (Previti & Amato,

2004). Even subtle relationship changes, as when the male increases attempts to control his mate's behavior (guarding), may influence a woman's feelings about her relationship (Gangestad, Thornhill, & Garver, 2002). Thus, feelings about a relationship are responsive to ongoing events, and this is consistent with the argument that relationship feelings can serve as information about the quality of a mate. To the extent that feelings serve this important role, fertility should be a time of increased monitoring of relationship relevant thoughts and feelings, even if this monitoring is outside of conscious awareness. In other words, if a woman is garnering implicit cues about the quality of her partner as a sire for her offspring based on feelings about her relationship with him, then she may be particularly focused on her relationship when she is able to conceive. Consistent with this, fertile women seem to be more focused on their romantic relationships in general (i.e., they *scrutinize* their relationships more; Hassebrauck, 2003).

Ovulatory shifts in emotions and feelings

Consistent with a focus on relationship feelings and the processing of those feelings around ovulation, fertility may be a time when both positive and negative emotions increase relative to the rest of the cycle. Haselton and Gangestad (2006) found that women feel more sexy and attractive at estrus relative to their own reports on non-fertile days. Feelings of well-being have also been found to be highest at fertility (Sanders, Warner, Baeckstroem, & Bancroft, 1984; Warner & Bancroft, 1988). Women reported being happier, more interested in the fertility study they were in, more confident, and sexier at interview sessions scheduled during their fertile phase than when they participated during a non-fertile phase (Graham, Janssen, & Sanders, 2000). The

consistent pattern here is that when a fertility effect is observed, women report stronger positive emotions at estrus.

But a more complicated pattern emerges for negative emotions. Although numerous studies have found no fertility effect in self-reported negative emotions (e.g. Van Goozen et al., 1997; Laessle et al., 1990), one recent study observed ovulatory increases in depressive symptoms, anxiety, and other symptoms of borderline personality disorder, but only in women high in those traits (DeSoto, Geary, Hoard, Sheldon, & Cooper, 2003). Krug and colleagues (1996) found that feelings of frustration and emotional response to jealousy both peak at fertility relative to other phases. Thus, the pattern for negative emotions is less clear than for positive emotions.

Taken together, it appears that estrus women may experience both higher positive and higher negative states, or higher affect intensity (Diener, Larsen, Levine, & Emmons, 1985). This means that fertile women experience an increased focus on their relationship feelings at the same time they may feel those relationship emotions more intensely, relative to non-fertile times.

To summarize, there is both theoretical and empirical support for the hypothesis that a woman's ovulatory inclination towards infidelity depends on her feelings about her relationship and her partner, and that high quality long-term pair bonds may, regardless of partner attractiveness, buffer women against ovulatory increases in negative feelings about their relationship. Thus, women who are satisfied with their relationship should feel just as positive (or more positive) about their romantic situation when they are fertile as not. In contrast, women who are paired with poor long-term mates are predicted to

feel more negativity about their relationships when they subject those relationships to increased scrutiny during peak fertility (see Figure 1).

Notably, the evolutionary logic we outline predicts exactly what our common-sense tells us, and aligns with decades of mainstream research on relationships. That is, feelings of happiness with a partner and with a romantic relationship can protect a marriage against infidelity (Previti & Amato, 2004), perhaps in part because good quality relationships buffer women against ovulatory increases in dissatisfaction with a relationship that accompanies the shifts in mate preferences and sexuality. We therefore posit that shifts in relationship feelings underpin the adaptive mechanisms of dual sexuality and strategic pluralism, and we test the idea that the quality of a romantic relationship buffers a woman from ovulatory increases in feelings and emotions that would otherwise shift their attention away from their primary pair bond.

In order to understand how the quality of a pair bond impacts the nature of ovulatory shifts in sexual interest via emotional mechanisms, we must first outline the important dimensions of pair bonding and the nature of feelings about the romantic relationship.

Relationship quality: Important dimensions of relationship functioning for female reproductive success

Research informed by evolutionary tradition has argued that a good mate for a woman is 1) a man who offers stability and loyalty (i.e., he sticks around to raise the offspring), 2) who contributes resources to the family (i.e., he doesn't squander resources on drinking or on other women), and 3) who is willing and able to protect his mate and family from harm (in other words, he is high in paternal investment, see Geary & Flinn,

2005; for a discussion of male attributes ranked highly in long term mates, see Gangestad et al. 2007). Thus, socially or financially successful men who are generous with their resources and demonstrate commitment and long term loyalty would embody the characteristics of a good mate from an evolutionary perspective.

Although mainstream research has focused on different aspects of relationships than research from the evolutionary perspective, the two approaches nevertheless agree on the markers of high relationship quality. Researchers who study relationships typically categorize high quality relationships as having high levels of satisfaction and commitment and low levels of conflict and abuse for both partners (Rusbult & Van Lange, 2003). These dimensions mesh in light of research showing that people who are satisfied and committed to their relationships have 1) more stability in those relationships and experience lower levels of infidelity (Drigotas et al., 1999). From the women's perspective, this means the males are more likely to invest in offspring. In addition, people who are satisfied and committed 2) typically enjoy adequate financial health (Vinokur, Price, & Caplan, 1996), and feel that family responsibilities are equitably distributed (DeMaris, 2007) which is consistent with men investing resources in the relationship and family. Satisfied people also 3) have lower levels of conflict and lower levels of physical abuse (for a review of this research, see Rusbult & Van Lange, 2003), which is consistent with the male providing protection for his mate. Thus, the strong links between a woman's feelings of satisfaction about and commitment to her relationship and the long term health and stability of the bond suggest that positive relationship feelings are associated with high quality pair bonds. And relevantly, children who are reared by their biological parents in stable, high quality relationships are more

likely to attain a healthy and successful adulthood (for a review, see Geary & Flinn, 2005).

Operationalizing a high quality pair bond would thus require not only indexes of objective commitment and investment, but also subjective markers of satisfaction and psychological commitment and investment. Therefore, markers of relationship quality such as *relationship status*, *resource investment*, *physical abuse*, and *satisfaction/commitment* together should provide an index of the complex ways that relationships vary in quality.

Feelings that may shift with fertility

In contrast to the objective and subjective markers of global relationship quality, *feelings* about a relationship or partner, as consciously perceived and reported, are thought to be more volatile, situation dependent, and ephemeral (Mikulincer & Shaver, 2005). Positive and negative feelings about a partner appear to index day-to-day here-and-now relationship functioning. As would be expected, in daily diary studies relationship feelings are generally associated with relationship quality, such that more positive feelings are reported from women who also report high satisfaction and commitment, and low levels of abuse or conflict (Barrett et al., 1998). Likewise, negative feelings are more commonly reported in relationships associated with low satisfaction, infidelity by either partner, and abuse or conflict (Barrett et al., 1998). Moreover, the results from diary studies have repeatedly demonstrated that feelings are readily changed by environmental context (Clark & Watson, 1988) and therefore serve as ideal candidates for the study of shifting social psychological processes (Cranford et al., 2006). Thus, positive and negative feelings about a partner and the relationship are good

candidates to use as indicators of emotional mechanisms that influence ephemeral ovulatory shifts in mate preferences and sexuality.

In addition to positive and negative feelings, more complex feelings are experienced and may be measured. By definition, ambivalence is experienced when both positive and negative feelings co-occur and are salient (Sincoff, 1990). Priester and Petty (1996) claim that ambivalence is best conceptualized as the subjective recognition of positive and negative feelings as "conflicted", "mixed", or "indecisive" feelings toward a target. But Thompson and Holmes (1996) disagree, and argue that individuals can be aware of both positive feelings and negative feelings yet not experience their co-existence as a conflict, which means that although they feel ambivalence by definition, they report no (or few) conflicted feelings. Also, subjective reports of "conflicted," "torn," or "confused" feelings appear to be more a function of *negative* feelings than of ambivalent (simultaneous positive *and* negative) or positive feelings (Ito, Larsen, Smith, & Cacioppo, 1998; Thompson & Holmes, 1996). Ambivalence and conflict thus are thought to index composite or complex feelings, but not the same ones.[1] As is the case for negative feelings, increases in these complex feelings may facilitate an ovulatory focus away from the pair bond. Thus we propose to examine ovulatory shifts in four categories of explicit relationship feelings: positive, negative, ambivalent (simultaneous positive and negative), and conflicted. Specific hypotheses are outlined below.

Hypothesized ovulatory shifts in feelings

So far, we've discussed evidence that feelings about a relationship can predict infidelity, and have hypothesized that when women are in the fertile part of their cycle, they are both more focused on the subjective quality of their relationships and more prone

to positive and negative emotions than at other cycle times. We have hypothesized that reported feelings about a relationship may shift at fertility more for women in low-quality relationships than for women in good relationships. And we have cited findings that women prefer more physically attractive partners at fertility relative to their partner preferences at other cycle phases.

In addition, positive relationship feelings prevail in high quality relationships and negative feelings are reported in poor ones (Barrett et al., 1998). Conflicted or unsure feelings are likewise associated with poorer relationships (Braiker & Kelly, 1979) and high levels of ambivalence toward a partner's attributes predicts dissolution over and above reported love or commitment (Thompson, 1995). This suggests that both conflicted and ambivalent feelings are linked to negative relationship outcomes. Together these data suggest that relationship quality and relationship feelings should be strongly linked, such that women in higher quality relationships will report more positive and less conflicted, ambivalent, and negative feelings relative to women in lower quality relationships. We can now synthesize these findings to form specific hypotheses.

What will happen to relationship feelings when women are fertile? If fertile women are simply ruminating more about males and relationships and those thoughts have more emotional intensity, then fertile women should show higher levels of *all* categories of relationship feelings relative to women in other cycle phases regardless of the quality of their relationship. However, if good pair-bonding qualities in a mate buffer a woman from increases in negative relationship feelings, then only fertile women in poor quality relationships should show ovulatory shifts in negative, conflicted, and ambivalent feelings. Specifically, women paired with mates who abuse them, who do not invest in

them, or who are not committed to them may experience increased negative, conflicted, or ambivalent feelings about their relationships when they are fertile relative to other times of their cycle and relative to women in good relationships. This pattern is shown in Figure 1, Panel A. Similarly, we might expect that increases in positive relationship feelings will be observed only among women in good quality relationships, as shown in Figure 1, Panel B.

Method

Overview

We examined relationship quality and relationship feelings (positive, negative, ambivalent, and conflicted) in a mixed-race community sample of 353 young women whose pair-bonding status ranged from seriously dating to married (some for over 10 years). We expected to find interactions to support our hypothesis that fertile women in high quality pair bonds are buffered from ovulatory changes in relationship emotions that would shift their interest toward extra pair men.

Participants

The women in this study were a subset of participants in a longitudinal study of adolescents and young adults. Data for the primary analysis were obtained from the 3rd wave of interviews (T3, completed in 2000-2002) because cycle phase data were only available from this wave. At Time 1, random-digit-dial techniques were used to identify a sample of 2,544 adolescents, aged 13 to 19, residing in Buffalo, NY. Telephone exchanges in areas populated primarily by Blacks were over-sampled. Interviews were completed with 81% (N = 2,052; females = 1,034) of the identified sample. Approximately 86% (n = 888) of the T1 women were re-interviewed at T3; average age

at T3 was 26.7 (± 2.2) years, and the T3 female subset contained an almost even representation of Blacks (n = 410) and Whites (n = 405). No differential attrition occurred by race among women between T1 and T3.

At T3, only those women who reported that they were currently in a romantic relationship (described as at least "dating seriously") were asked about the quality of their romantic relationship. Of those 563 paired women, the 38 who were currently pregnant and the103 who described their cycles as irregular were not asked about their cycles. Of the 422 who reported complete cycle information, 23 reported a most-recent-period (MRP) that indicated they could have been pregnant, and 3 others gave a date in the future. Another 36 women indicted that their cycles differed more than 3 days in length from one to the next. Three (3) women had particularly long cycles (>35 days), and 3 had very short cycles (< 21 days). Because these cycle characteristics make it impossible to identify fertile from not fertile days (Dunson, Baird, Wilcox, & Weinberg, 1999), they were also dropped. The final sample included 354 women; Figure 2 depicts the sample identification stages.

The 354 included women differed from the 534 excluded women in that they were less likely to be Black (51% of excluded vs. 40% of included, $t(783.8) = 3.11$, $p < .01$), more likely to be using contraceptive pills (27% of excluded vs. 47% of included, $t(713.6) = -6.18$, $p < .001$), and a few months older (included age = 27.5, excluded age = 27.2; $t(886) = 1.97$, $p < .05$). All three of these factors are associated with the probability of being in a relationship (Laumann, Michael, Gagnon, & Michaels, 1994). There were no differences in either household income or the woman's own income. Thus the observed differences between included and excluded women appear to reflect the fact

that only women in relationships were included in this analysis. Consistent with this, the subset of 209 women who were in relationships but were excluded due to our inability to categorize them as fertile did not differ from the 354 included women in race, age, household income, or own income. However, the women excluded on the basis of cycle information were significantly less likely to report birth control pill use (47% included vs. 29% excluded; $t(449.1) = -4.38$, $p < .001$). This difference likely reflects the fact that pill use increases the regularity of one's cycle which in turn makes it easier for women to remember where they are in their cycle and how long it typically lasts. Thus, partnered women who take birth control pills were more likely to remember and provide the information we needed to categorize them as fertile (and were more likely to have regular cycles), and thus were over-represented in our sample relative to partnered women who do not use pills.

Procedure

Face-to-face, computer-assisted interviews that included both self- and interviewer-administered portions were conducted in private by trained same-sex interviewers for 78% of the women at T3; the remaining women completed telephone interviews. The interview sessions lasted approximately 3 hours. More sensitive questions (e.g., on sexual behavior) were self-administered. Respondents were paid for their participation.

Estimating Fertility

At T3, women were given calendars and asked to identify the date that they began their most recent period (MRP). We counted elapsed days from the date of onset to the date of their interview (e.g., if they indicated the day before the interview as their MRP,

they were on day "1"). They also reported the average or typical length of their menstrual cycles (how many days apart their periods begin). We computed the number of days until their next period by subtracting the counted days (above) from their reported length of cycle (e.g., if they reported 28 days between periods, and they were on day "1" above, they were coded as being 27 days from their next period). Then we identified women as fertile using the backward day count method (Wilcox, Weinberg, & Baird, 1995). By this method, women who were more than 20 days or less than 15 days from their next expected period were coded as non-fertile. Women who were between 15 and 20 days (inclusive) from their periods were coded as fertile (i.e. six fertile days; Dunson et al., 1999). Using those guidelines we had 67 fertile and 287 non-fertile women.

Measures

This section first describes five measures that index relationship quality, distinguishing male partners who are more likely to contribute to a woman's reproductive success from those who cannot or will not contribute. The four types of relationship feelings (outcomes) are then described.

Relationship Quality

Relationship status. Higher quality relationships typically have higher levels of commitment (Rusbult, 1980). Objective commitment to a relationship can be indexed by *relationship status* because men who marry have demonstrated more commitment to a relationship relative to men who are only dating, in part because the act of marriage universally confers legal and social resources to a woman and her offspring (Eskridge & Spedale, 2006). For relationship status, women selected the highest-numbered category of the following four categories that fit their circumstances: 1) seriously dating, 2) living

with partner, 3) engaged, and 4) married. The modal response was married, chosen by 164 out of the 354 women, and the smallest category was the 70 dating women. A Chi Square test of independence confirmed that fertile women were represented equally in the four relationship status categories (χ^2 (3) = 0.55, p = .98.

Resource investment. Another objective measure of relationship quality is contribution to the household (income, child care, chores, etc); offspring whose parents invest time and resources in them are more socially competitive in modern societies and suffer lower mortality in other socieities relative to neglected or deprived children (for a review, see Geary & Flinn, 2005). In our data, we assess mate contribution of resources by the proportion of total household income contributed by the male partner. Each woman reported her own yearly income, and her total household income. So for women who lived with their partner, we estimated mate contribution of financial resources by subtracting her reported income from her reported household income. Partners who were not living together were assigned $0 for income contribution. And because a woman will view her mate's income from the perspective of her own contribution, we calculated the male's income as a percentage of total household income. Thus, a man who contributes $30K to the household as the only wage-earner will have a score 1.00 on this measure (the highest possible), but the man who contributes $30K when his wife contributes $70K will only score 0.30 (or 30% of $100K). [2]

We also used a second, more subjective index of mate contribution of resources. We reasoned that income, although culturally valued as a male contribution to families, not only fails to index the variety of ways that men can contribute resources to a household, but beyond a comfortable minimum, increased income is not linked to

happiness and well-being (Diener & Oishi, 2000). Therefore, for a more subjective index of mate impact on family resources, we used responses to the single question "How much does *partner-name* affect your financial situation?" and women responded from 1 = "not at all" to 5 = "a great deal". This variable was substantially positively correlated with the mate income variable above ($r = .44$, $p < .001$) suggesting that the two measures are linked, but the correlation was not so strong that the two measures chould be combined into a single measure of the same underlying construct.

In the sample of included women, her earned income ranged from \$0K (n = 22) to \$120K with a median of \$18K. Household income for women who lived with their partners ranged from \$2K (n = 1) to "over \$200K" (n = 2) with a median of \$37K. Mate income (obtained by subtraction) ranged from \$0 to \$184K, with a median value of \$20.5K. As would be expected, male income proportion was negatively correlated with the woman's income ($r = -.18$, $p < .01$) because on average, the more money she made, the lower the percentage of total income he could contribute. Subjective impact was uncorrelated with the woman's own earned income ($r = -.05$, $p = .34$).

Physical abuse. We argued earlier that *protection* was a significant dimension of relationship quality from an evolutionary perspective, and this is typically conceptualized as protection from other men (Geary, 2000). However, in American populations like our sample, adult women are more likely to suffer from physical abuse from their romantic partners than from any other source (e.g., patriarchal terrorism; Johnson, 1995). Partly for this reason, in the present study we use a measure of physical abuse to index protection. Also consistent with abuse as a lack of "protection," women who are abused not only suffer reductions in their own abilities to nurture their children, but also place

their offspring at higher risk of harm relative to children of women who are not abused (Daly & Wilson, 1996). Physical abuse was indexed with three items from the original Conflict Tactics Scale (CTS; Straus, 1979). These items were all preceded by the stem: "When the two of you have a disagreement, how often does *partner-name*…" Endings were "…push, grab, or shove you?" "…slap you?", "…hit, punch, kick, or bite you?" etc. The responses categories ranged from 1 = "never" to 5 = "all of the time." Thus, the higher the score on this measure, the more the woman reported that her partner expresses physical aggression towards her. For ease of interpretation, this measure will be reverse scored in all analyses; thereby making higher scores correspond to better quality relationships (less abuse), which is then consistent with all our other measures.

Satisfaction/Commitment. Subjective indexes of relationship quality capture more psychological dimensions of relationship well being. Reported *satisfaction* with, and psychological *commitment* to the mate and relationship are strongly linked markers of relationship health, and fairly stable from month to month (the relevant time frame here; Neff & Karney, 2005). In fact, in longitudinal studies, marital satisfaction shows one-year stabilities above $r = .70$ in contrast to measures of mood or depressive symptoms, which show stabilities below $r = .40$ (e.g., Fincham & Bradbury, 1993).

Thus, for our subjective assessment of relationship quality, we used a four-item composite of reports about satisfaction and commitment. These items were "how happy are you in your relationship?" and "how satisfied are you with your relationship?", "how committed are you to maintaining your relationship?" and the reverse-scored "how likely is it you will end your relationship in the near future?" Responses were given on a scale from 1 = "not at all" to 7 = "extremely." Supporting their use as a composite, all four

items loaded on one factor, and all loadings were greater than .69. Means, standard deviations, and reliabilities for all independent measures are given in Table 1.

Relationship feelings

Participants responded to two positive, two negative, and two conflicted relationship items. The positive items were "Ignoring the *negative* and focusing only on the *positive*, how *positive* do you feel about …your relationship" or "… about *name of partner*". Ratings were made on a likert scale ranging from 1 = not at all *positive* to 9 = extremely *positive*. Negative feelings were measured by switching the words *positive* and *negative* in the above items and response scales. Using the same endings, conflicted feelings about the relationship and partner were assessed using the stem: "Focusing on BOTH the *negative* and the *positive*, to what extent do you have CONFLICTED thoughts and feelings about…," with the response scale ranging from "not at all *conflicted*" to "extremely *conflicted.*"

Positive (P), negative (N), and conflicted feelings were then computed as the mean of the two ratings (relationship and partner). Finally, we computed ambivalence scores following Thompson and Zanna's (1995) similarity-intensity formula:

$$\text{Ambivalence} = \frac{(P + N)}{2} - |P - N|$$

We chose this formula from among the six that have been proposed in the literature because Breckler (1994) maintains that this formula not only best captures the underlying theoretical structure of ambivalence, but also results in the best distribution of computed scores out of the six formulas. With the 9-point response scale, maximum ambivalence (neg = 9, pos = 9) is a score of 9, maximum indifference (neg = 1, pos = 1) lies in the middle of the distribution and corresponds to a score of 1, and maximum polarity (neg =

9, pos = 1; or neg = 1, pos = 9) gives an ambivalence score of -3. Thus, polar feelings are scored lower than indifference.

Notably, the women in this sample generally reported more positive feelings about their relationships than negative ones. About 20% of the women (90 women) were completely polarized in that they scored a mean of 9 (rating from 1 to 9) on positive feelings and a mean of 1 on negative feelings, thereby scoring -3 for ambivalence. Similarly, almost 30% (118 women) reported no conflicted feelings at all. In contrast, only two women reported the highest possible negative feelings score (9) and three reported the highest possible conflicted score (9). These were not the same women who showed the highest ambivalence scores, rather those maximum scores were held by three women who scored between 6.0 and 7.0 out of 9 possible, and their high scores resulted because they reported substantial amounts of both positive (~ 9/9) and negative (~ 7/9) feelings. Descriptive statistics, reliabilities, and intercorrelations for ambivalence, positive feelings, negative feelings, and conflicted feelings are provided in Table 2.

Results

This section is organized by three major aims. We begin with 1) preliminary analysis which are comprised of four distinct parts. A) We first test potential covariates for suitability of inclusion in our regression models and then B) check that our data meet the assumptions of multiple regression. Then we C) verify that our relationship quality measures conform to our theoretical expectations (e.g., that our "stable" markers of relationship quality are *stable* across the ovulatory shift). Finally, we D) explore the differences between the women who use hormonal birth control (pills) vs. those who cycle naturally. Our second major aim is to 2) look for a *main effect of fertility* phase in

relationship feelings, which would be consistent with a general shift in emotions at fertility because previous findings suggested that we might observe a general ovulatory increase in positive and negative feelings. For our third and final aim, we focus on our primary hypotheses and 3) test interactions between fertility phase and relationship quality to determine if women in *good quality relationships are buffered from ovulatory shifts in feelings* that serve to focus their interest away from their mate and pair bond.

Preliminary analysis

Covariates.

Covariates are included in regression models when they explain a significant amount of variance in the outcome (Pedhazur, 1997). Because relationships differ systematically for people of different ages and races (Laumann, Michael, Gagnon, & Michaels, 1994), we reasoned that relationship feelings might also differ systematically among those groups, so we tested age and race for inclusion as covariates in our models. A dichotomous race variable distinguished Black (40%) from non-Black participants. Age at interview was calculated from birth date to the nearest hundredth of a year; thus a woman who was interviewed two days past her 25th birthday would have an age of 25.01.

For the feelings outcomes, the only relationship we found was that Black women reported more conflicted feelings ($r = .13$, $p < .05$) than non-Black women. We then verified that race did not moderate an ovulatory shift in conflicted feelings (i.e., we tested that race met the heterogeneity of slopes assumption for covariates in regression; Pedhazur, 1997). This suggests that race should be included in our conflicted feelings models, so we included it.

In addition to race and age, we also tested contraceptive pill use as a potential covariate. Although we did not expect pill use to predict variance in relationship feelings, the nature of ovulatory shifts is thought to be altered by the use of hormonal birth control (Thornhill, 2006) and thus many fertility researchers (e.g. Haselton & Gangestad, 2006) exclude women who take birth control pills from their studies. We found that pill use was uncorrelated with relationship feelings (all four outcomes showed $r < .05$ and non-significant p-values), suggesting that women who use pills did not differ from those who do not in average levels of relationship feelings. We then looked for evidence that women who used pills differed from non-users in the nature of ovulatory shifts in relationship feelings by testing the interaction between pill use and fertility predicting the four feeling outcomes. The interaction betas ranged from .00 to .07, and none was significant. This means that pill use did not systematically affect the way in which fertility impacted women's feelings.

Because 48% of the women in our sample reported pill use, the exclusion of pill-using women from our analyses would both reduce the generalizability of our findings and decrease our power to detect effects. Considering these decrements in combination with the evidence that pill use did not moderate an ovulatory shift in relationship feelings, we chose to retain women in our analysis regardless of pill use, and we do not include pill use in our regression models as a covariate (Pedhazur, 1997).

Assumptions for regression.

The distributions of the four dependent variables met assumptions of normality for regression outcomes (i.e., they had acceptable values of skew and kurtosis). We conducted a series of multivariate outlier tests to determine if any one of our cases

exerted an overlarge influence on the outcomes. Specifically, we examined leverage values, Cook's distances, and Mahalanobis distances as recommended by Pedhazur (1997). We identified one woman whose inclusion in the analysis exerted a high degree of influence on the outcomes across more than half of our regression tests. For example, we observed Mahalanobis distances for this woman in excess of 387.0 in four of our models, which exceeds the critical value for a model with three *df*'s of $\chi^2(3) = 16.27$ (Tabachnick & Fidell, 2001). Her scores also earned leverage values (which should not go above 1.0; Pedhazur, 1997) as high as 1.34.

This particular woman was fertile when she was interviewed and reported that her dating partner abused her; she shared the highest value for physical abuse with one other woman. She also had the shortest relationship duration of any woman included in the sample, reporting that she had been with her boyfriend about one month. When we included her in our analysis for the physical abuse moderation test, we observed no significant outcomes, but we found effects when she was excluded. Although differences were less dramatic for the remaining analyses, we chose to exclude her from all analyses due to the large values in the outlier tests, thus reducing our sample to 353 women.

Validity of relationship quality measures

A core assumption about our measures of relationship quality is that they are relatively stable as women move across the fertility cycle. To check that the fertile vs. non-fertile women did not differ, we estimated correlations between fertility and the markers of relationship quality. The correlations ranged in magnitude from $r = .00$ (financial impact) to $r = .08$ (income percentage), and none was significant (see Table 1).

Thus, as expected, these markers appear to index dimensions that are stable across the ovulatory shift.

A second important assumption is that our markers of relationship quality index dimensions of relationship well being. Therefore we expect to see significant positive relationships among these markers, consistent with our underlying premise that relationships that are stable and healthy will generally be higher in relationship status, lower in abuse, higher in male contribution of resources, and higher in satisfaction and commitment. Overall, this is the pattern of correlations we found (see Table 1). The highest correlation was observed between mate income proportion and relationship status ($r = .54$, $p < .001$), suggesting that men provide a greater percentage of household income to their wives than their girlfriends. The only non-significant correlation was between the physical abuse measure and mate's financial impact ($r = .05$, $p = .39$). Notably, none of the correlations was large enough to suggest that the different measures were tapping into the same aspect of relationship quality. This pattern is consistent with the hypothesis that these measures capture distinct aspects of relationship.

Finally, the relationship quality markers should be linked to the relationship feeling outcomes such that relationship quality is positively linked with positive feelings and negatively linked to negative, ambivalent, and conflicted feelings. All twenty correlations (5 relationship quality measures X 4 feeling outcomes) showed the expected direction, and all but three were either significant or marginally significant (see Table 3). The three non-significant relationships were between mate's income proportion and positive feelings and between financial impact and both negative and ambivalent feelings.

Notably, we found large correlations between reports of satisfaction/commitment and relationship feelings ($r \sim .6$ to .8).

Substantive tests of feelings and relationship quality

The remaining two aims test whether women experience and report more emotions about their relationships when they are fertile, regardless of the kind of relationship they are in (i.e., main effects of fertility), and whether relationship quality (RQ) buffers ovulatory shifts in relationship feelings (fertility X RQ interactions). We therefore estimated a series of 20 moderated regression analyses, entering fertility and one of the five RQ markers at step 1, and entering the (fertility X RQ) interaction term at step 2, resulting in five RQ models predicting each of the four feelings outcomes. In these models and those described hereafter, we followed the recommendations of Aiken and West (1991) for testing interactions in regression models, first centering the covariates and potential moderators (viz., relationship status, financial impact, male proportion of income, reverse-scored physical abuse, satisfaction/ commitment) prior to computing interaction terms and estimating our models. Significant interactions were probed by estimating simple slopes between fertility and the outcomes at the 20^{th} and 80^{th} percentile of the moderators (Pedhazur, 1997). The regression betas for the interaction terms for all 20 models are provided in Table 4.

Main effects of fertility on feelings

To determine if fertility impacts relationship emotions at a global level, we inspected the beta weights at Step 1 of the interaction models. For aversive feelings (viz., negative, conflicted, and ambivalent), none was significant, with standardized regression weights ranging from -.02 to -.06. However, we found one marginally significant

relationship with positive feelings ($\beta = .07$, $p < .1$) such that fertile women reported more positive feelings than non-fertile women when satisfaction/commitment was in the model. Although we should have found an effect of this magnitude by chance alone given the number of tests we conducted, the effect is nonetheless consistent with previous findings that women experience more positive emotions when fertile. However, overall this pattern suggests that fertility is not exerting a strong influence on relationship feelings at a global level or in a "typical" way.

Moderation of negative feelings

We predicted that negative feelings would increase at fertility primarily among women in poor quality relationships. Consistent with this hypothesis, three of our five relationship quality measures moderated ovulatory shifts in negative relationship feelings. Plotting the interactions showed a pattern that generally supported our hypothesis.

As shown in Figure 3, panels A and B, the pattern for relationship status and financial impact were highly similar. Fertile women in low quality relationships were (non-significantly) more negative than their non-fertile counterparts, whereas fertile women in high quality relationships were (significantly) less negative than their non-fertile counterparts. The third interaction was similar in that we found more strongly negative feelings among fertile women in abusive (i.e., low quality) relationships than among their non-fertile counterparts, but the pattern differed in that no difference was observed between fertile and non-fertile women in non-abusive relationships. Of the three interactions, the abuse outcome conforms most closely to the classic buffering pattern we initially expected.

Taken together these outcomes are consistent with our predictions, with one caveat. We thought that negative feelings would *increase* at fertility in women unless buffered by a good relationship and we indeed found evidence for this in physically abused women. But the other two outcomes suggest that negative relationship feelings actually *decrease* at fertility among women in good relationships. Nevertheless, the end result is that women in good relationships feel *less* negative about their mates during the fertile phase, whereas women in poor relationships feel *more* negative. Though not in the precise form we predicted, this pattern is broadly consistent with the underlying premise that women in low quality relationships, relative to those in better ones, experience an emotional distancing from their relationships that might underlie the ovulatory propensity toward infidelity.

Moderation of conflicted feelings

As discussed previously, conflicted feelings are thought to reflect the extent to which women experience and consolidate negative feelings into their overall feelings about their relationship (Thompson & Holmes, 1996). We argued that fertility was a time when women might be particularly systematic in the cognitive processing of relationship relevant thoughts and might experience more intense emotions. Thus we predicted that fertile women might report more conflicted feelings, but also that good relationships would buffer this increase. Consistent with this, we found that financial influence moderated an ovulatory shift in reported conflicted feelings.

Plotting the interaction revealed a form similar to that observed for the relationship status X fertility shift interaction on negative feelings. In this case, fertile women who were highly financially impacted reported lower levels of conflicted feelings

at fertility than non-fertile women, whereas low impact women reported more conflicted feelings than non-fertile women (although this simple slope was not significant; see Figure 4). Although only one of the five relationship quality measures moderated the fertility shift in conflicted feelings, this interaction was again consistent with the hypothesis that high quality relationships buffer women from aversive feelings about their relationships when they are fertile.

Moderation of ambivalent feelings

As described earlier, the women in this sample were generally quite positive about their relationships (mean = 7.6 out of 9), and thus the ambivalence scores we observed were highest among the women who experienced negative feelings in conjunction with their positive feelings. Ambivalence should thus be categorized with aversive feelings, which is also consistent with the fact that ambivalent feelings correlate positively with negative feelings and negatively with positive feelings. Therefore, we predicted that women in good relationships would be buffered from ovulatory increases in ambivalent feelings. Consistent with this hypothesis, four of the five markers of relationship quality (all but income percentage) moderated ambivalent relationship feelings. Plotting the interactions revealed a general pattern in which ambivalent feelings increased at fertility among women in low quality relationships, but decreased among women in high quality relationships.

In particular, we found that both married women and financially impacted women who were fertile reported significantly less ambivalence than all other women (figure 5, panel A and B). As shown in figure 5, panel C, fertile abused women reported by far the highest levels of ambivalence; at the 80th percentile of our abuse variable, the predicted

value of ambivalence was 3.04, which was roughly two standard deviations above the mean for ambivalence. Surprisingly, however, abused and non-abused women differed only at fertility. And notably, the moderation of the ovulatory shift in ambivalent feelings by physical abuse conforms to the buffering pattern we predicted, as did the previously described moderation of the shift in negative feelings by abuse.

And finally, we found a strong main effect of satisfaction/commitment on ambivalent feelings, and simple slopes that once again showed different signs. Here, fertile women who reported high levels of relationship satisfaction/commitment reported significantly less ambivalent feelings relative to all the other women, (figure 5, panel D). Taken together, these results support the interpretation that fertile women in good quality relationships are buffered from aversive relationship feelings at fertility.

Moderation of positive feelings

Shifting our focus from aversive feelings to positive ones, we next examined relationship quality by fertility interactions on positive feelings. In contrast to the consistent findings for aversive feelings, we found only one significant interaction out of the five models we tested: Women's reports of physical abuse by their mates moderated ovulatory shifts in positive emotions. As shown in Figure 6, fertile vs. non-fertile women in good relationships report more positive feelings, whereas fertile vs. non-fertile women in poor relationships reported significantly less positive feelings.

Although only one of five interaction tests were significant, the moderation of fertility by physical abuse again shows the buffering pattern we hypothesized, and is consistent with the overall prediction that fertility buffers women in high quality

relationships from increases in negative relationship feelings (or decreases in positive feelings) that may turn women's thoughts to extra-pair sex at fertility.

Summary of moderated regression outcomes

We found three outcomes that were consistent with our hypothesis that that a high quality relationship buffers a woman from ovulatory changes in emotions that would shift her interest toward extra pair men. In addition, we found six additional outcomes that suggest that women in good relationships are especially content with their partners at the time ovulation fertility, which implies they are less likely to be unfaithful at that time. However, our core assumption that high quality pair bonds are distinct from partner attractiveness has not yet been properly tested. It might be argued that the relationship quality indicators used here are instead proxies for partner attractiveness. In other words, it is possible that relationship quality is correlated with attractiveness (because, for example, taller men earn higher incomes; Hamermesh & Biddle, 1994), which might make our findings mere replications of the previously documented ovulatory preference for attractive males. For that reason, we conducted supplementary analyses among a subset of women (n = 187) for whom partner ratings of attractiveness were available. Among these women, we first explore the links between partner attractiveness (PA) and relationship quality (RQ). Next, we examine the interaction between fertility and PA predicting relationship feelings and then test whether PA effects are independent of RQ at both the main effect and interaction levels. We begin with hypotheses.

Supplementary Analysis: Partner Attractiveness

Hypotheses

H1: PA and RQ represent related but distinct aspects of relationship functioning. Although we do not view attractiveness as a component of pair-bonding quality, previous research has found that attractive men enjoy higher incomes (Mulford, Orbell, Shatto, & Stockard; 1998); thus we predict that PA will be positively related to male income in our data. As discussed previously, male attractiveness is correlated with high androgen levels (Gangestad & Thornhill, 2003), and high androgen levels are also correlated with elevated reactive aggression (Benderlioglu et al., 2004). This suggests that attractive partners may also be more abusive. High androgen levels are also *negatively* linked to generosity toward mate and family (Puts, 2005), which suggests that PA should be negatively related to financial impact and perhaps relationship status (i.e., high PA men may be less likely to marry; Grey et al., 2002). Thus, we hypothesize that PA will be positively linked with some measures of good relationship quality (viz., income) but negatively associated with others (viz., lack of abuse, financial impact, satisfaction/commitment, relationship status).

However, despite the modest overlap expected between PA and measure of RQ, we believe that PA and RQ are distinct dimensions of mate value and will be independently predictive of relationship feelings. Accordingly, we expect that previously observed relationships between RQ and relationship feelings will hold even after controlling for partner PA.

H2: Partner attractiveness will moderate the ovulatory shift in relationship feelings. Like good pair-bonding, partner attractiveness is a desirable quality for a mate. Therefore, a woman should feel more attraction to an attractive mate at fertility relative to

the other cycle phases. Thus, the second hypothesis is that PA will moderate relationship feelings in patterns similar to those observed for RQ.

H 3: PA and RQ will exert independent interaction effects with fertility. Following from our argument, we expect that previously observed RQ X fertility interactions will hold even after controlling for simultaneous PA X fertility interactions.

H 4: PA and RQ may jointly moderate relationship feelings. Because partner attractiveness and relationship quality are conceptualized as distinct components of mate value, they may jointly moderate fertility effects on relationship feelings. In other words, we might expect a 3-way interaction in which fertile women mated with unattractive, poor pair-bonders should feel particularly negative, ambivalent, or conflicted about their relationships, and fertile women mated with attractive, good pair-bonders should feel particularly good about their relationships. Fertile women whose mates are either attractive or good pair-bonders but not both should fall somewhere between those two groups.

Partner-rated attractiveness measure

Although much of the empirical research on ovulatory shifts in attractiveness has focused on *objective* markers of physical desirability (e.g., other-rated attractiveness, symmetry, height, etc; for a review see Thornhill, 2006), only subjective ratings of partner attractiveness were available in this data set. However, subjective attractiveness is positively related to objective attractiveness (Sangrador & Yela, 2000), so it reasonable to assume that we might see a similar pattern of effects.

Although partner attractiveness ratings were not assessed at wave 3 when cycle and relationship quality information were collected, PA was assessed in prior interviews.

Drawing on these data, we were able to construct a measure of PA for 187 of the 353 women who were in a relationship with their wave 3 partner at one or more of the prior waves.

The majority of the partner attractiveness ratings were obtained within three specific situations that women described in detail. Embedded in a series of questions about their first date, their first sexual experience, and their most recent sexual experience with their current romantic partner were two partner attractiveness questions: "To what extent did you think he was good-looking and attractive?" and "To what extent did you think he was sexually desirable?" Responses were given on a scale of 1 = not at all to 7 = extremely. The two items were strongly correlated, ranging across the situations from r = .51, $p < .001$ for first sex ever to r = .68, $p < .001$ for most recent sex. For 147 out of the 187 women we had more than one set of ratings about the partner, and for these we used a composite all available ratings. [3] The mean of the resulting measure was M = 5.90 (SD = 1.09), and reliabilities ranged from α = .57 for the women with only one pair of ratings to α = .84 for the 12 women who had 4 pairs of ratings.

Results of supplementary analysis

Do PA and RQ represent related but distinct aspects of relationship functioning? Although we predicted that PA would be positively related to income, and negatively related to relationship status, lack of abuse, and financial impact, in fact PA was unrelated to all RQ measures, with correlations ranging from r = .01 (relationship status) to r = .08 (financial impact). PA was also unrelated to relationship feelings, with the largest non-significant correlation between attractiveness and positive feelings (r = -.05, ns). Even though these data are not consistent with our specific predictions, they

nevertheless support our contention that RQ and PA represent distinct aspects of relationship functioning.

We also argued that if PA and RQ are independent, then the magnitude of RQ links to relationship feelings should be stable when partial correlations (controlling for PA) are estimated. Thus, we estimated 20 partial correlations between RQ and relationship quality (5 RQ measures X 4 feeling outcomes) controlling for PA.

For a fair test of the independence of PA and RQ, we re-estimated the bivariate correlations between RQ and feeling outcomes in the subset of 187 women with PA ratings. As shown in Table 6, comparing the bivariate and partial correlations in the same subset, we find that all nine of the significant bivariate correlations between RQ and relationship feelings are retained when PA is controlled, and an additional two partial correlations achieve significance. This outcome suggests that the RQ measures and PA explain different variance in relationship feelings, which means that they are empirically distinct constructs. In other words, relationship quality and partner attractiveness appear to be distinct components of mate value.

Does attractiveness moderate the ovulatory shift in feelings? We predicted that attractiveness would moderate the ovulatory shift in relationship feelings in similar patterns to those observed for relationship quality. Consistent with this hypothesis, three of four outcomes (all but positive feelings) were significantly moderated by PA. For negative feelings, the PA X fertility interaction regression weight was $\beta = -.14$, $p < .1$, for ambivalent feelings, $\beta = -.17$, $p < .05$, and for conflicted feelings, $\beta = -.29$, $p < .05$. Plotting the predicted values revealed almost identical patterns in the negative, ambivalent, and conflicted feeling outcomes (Figure 8, panels A, B, C). In every case

we observed significant negative simple slopes for the women with attractive partners and non-significant simple slopes for women paired with less attractive men.

In contrast, for positive feelings we observed a significant main effect of fertility ($\beta = .16$, $p < .05$), but no main effect of PA and no interaction. This suggests that when partner attractiveness is statistically controlled, fertile women feel more positive about their relationships than non-fertile women, which is consistent with the previously discussed increase in positive emotions at fertility.

It should be noted here that in the earlier RQ moderator models we observed only one significant outcome in the fertility X RQ interactions that predicted positive feelings, where abused women reported less positive feelings than other women. Perhaps the general high regard that the women in our sample had for their mates and relationships made it more difficult to detect the incremental changes in positive feelings on our positive feeling measure. Nonetheless, the outcomes for negative, ambivalent, and conflicted feelings are consistent with theoretical models that argue that women are focused on the genetic quality of a partner at fertility (e.g., strategic pluralism; Thornhill, 2006), because fertile women with attractive partners are experiencing lower levels of aversive feelings that might shift their interest from their partners.

Do PA and RQ exert independent interaction effects with fertility? As with the main effects, to the extent that PA and RQ are independent, then they should independently moderate the relationship feelings when both interactions are entered simultaneously into regression models. Thus, we once again re-estimated our 20 relationship quality moderation models (5 RQ measures X 4 feeling outcomes) entering

partner attractiveness and each RQ measure at step 1, and the two fertility interaction terms at step 2.

In general, the RQ X fertility interactions were similar to the ones we estimated in the larger subset with one notable exception: all previously observed effects with the abuse measure disappeared. Inspection of the abuse reports in the smaller subset may explain this outcome; only 14 of the 187 women (7%) reported any abuse at all, and only one of them reported that their partner slapped, grabbed, or pushed more often than "sometimes." In contrast, 57 of the 166 women (34%) who had not been with the same partner since T2 reported abuse ranging up to experiencing physical conflict "all the time." Without women in shorter relationships in the sample, we did not have enough abused women to detect the effects of abuse. Thus, we do not include those outcomes in our tables and subsequent discussion.

In Table 7 we compare the beta weights for the interactions when the predictors are entered into individual vs. combined regression models in the subset of 187 women. Of the eight RQ X fertility interactions that were significant in the individual models, only three were also significant in the combined model, and an additional three were qualified by 3-way interactions (see below). Thus we failed to replicate only two. Notably, all three PA X fertility interactions predicting the aversive feelings were significant in the individual models, and we found significant PA X fertility interactions in 5 of the 12 combined models, with at least one among all four of the RQ measures. Given the diminished power to detect effects, the overall pattern of beta weights depicted in Table 7 suggests that RQ explains different variance in relationship feelings than is

explained by PA, which is again consistent with the interpretation that PA and RQ do exert independent effects on relationship feelings across the ovulatory shift.

Consistent with our hypothesis that PA and RQ are distinct components of mate value, the combined models we replicated many of the significant effects we had found in the previous models. Specifically, And once again, none of the interactions predicting positive feelings was significant.

Do *PA and RQ jointly moderate relationship feelings?* We hypothesized that to the extent that PA is distinct from RQ, the two qualities may interact with fertility to impact relationship feelings. We estimated a series of 3-way interactions between relationship quality, partner attractiveness, and fertility. We did not test 3-way interactions with physical abuse, because as mentioned previously, we did not have sufficient numbers of abused women in our sample to detect effects. Thus, we tested 16 models, entering fertility, attractiveness, and one of the four quality measures at step 1, then the 2-way interactions (fertility X PA, fertility X RQ, PA X RQ) at step 2, and finally the 3-way interaction (fertility X PA X RQ) at step 3, predicting each of the 4 feeling outcomes. It should be noted that all these analyses were conducted only on the subset of 187 women who were in their relationship at least 4 years, and not the full sample used in earlier analyses.

In these models, a significant 3-way interaction indicates that relationship quality and attractiveness moderate fertility shifts in patterns that are not explained by the moderation models previously tested. That is, PA and RQ in combination predict relationship feelings differently for fertile vs. not fertile women. Regression statistics for step 3 of the 16 models are provided in Table 6.

Interpretation of the 3-way outcomes. Of the 16 models we tested (4 quality measures X 4 feeling outcomes), significant 3-way interactions were found in six models. None of the six included satisfaction/commitment. All six predicted an aversive outcome (negative, conflicted, or ambivalent feelings). We begin with a discussion of the 3-way effects, which are plotted as Panels A-F of Figure 8. (Note, these panels are organized to match the order in which we discussed each outcome in the preceding section.)

Rather than consider each outcome separately, we focus on commonalities across the six 3-way outcomes, thereby simplifying the process of connecting these results to our arguments about the moderation of fertility by attractiveness and relationship quality. Across all six outcomes, women who were paired with unattractive, poor-pair-bonders showed either an increase in aversive feelings when fertile relative to non fertile (Panel B, E, F, D) or high levels of aversive feelings that did not increase significantly (Panels A, C). A mate who is neither attractive nor a good pair bonder may not be the best sire for offspring, and these women generally experience higher levels of negative relationship feelings relative to all other women, particularly at fertility. In contrast, across all six outcomes, fertile women paired with attractive, high quality pair-bonders reported the lowest levels of aversive feelings relative to women in the other groups (all panels), and for two of the outcomes their aversive feelings were lower than non-fertile women in their category (Panels B, F). These women are paired with men who should be good sires for offspring, and their low levels of aversive relationship feelings reflect their contentment with their mate, especially when they are fertile.

The pattern for women paired with attractive mates who were poor pair bonders was also consistent across all six outcomes. These women reported high levels of

aversive feelings when they were not fertile, but in every outcome the reports plummeted to the lowest levels at fertility. This is consistent with the notion that women are focused on pair-bonding when they are not fertile, and may feel irritation toward poor bonding behaviors at those times. But when fertile, they may experience increased attraction toward their sexy partners, which decreases those aversive relationship feelings. This pattern is thus consistent with the idea that attractive men provide good genes and so women should find them desirable when they are fertile.

The pattern for women paired with unattractive, high quality pair bonders was as consistent across the outcomes with one notable exception. In the majority, these women tracked the women with attractive partners who were high quality pair bonders (Panel A, B, D, E, F), generally showing low levels of aversive feelings at fertility, but also typically reporting low levels when not fertile. In the one exception, the women whose unattractive mates provided most of their income reported high levels of ambivalence when not fertile, but very low levels when they were fertile, matching the slope for women paired with attractive men who contributed nothing to their household income (Panel C).

Summary. Overall, we found that both relationship quality and partner attractiveness showed similar but distinct patterns of influence on the ovulatory shift in relationship feelings. Taken together, these outcomes not only support our hypothesis that women in high quality relationships are buffered from aversive relationship feelings that focus their attention away from the relationship, but also buttress our argument that attractiveness and relationship quality are separate components of mate value with distinct influences on the ovulatory shift in relationship feelings.

Discussion

According to both good genes sexual selection and strategic pluralism, women should be more focused on the genetic quality of their partners at fertility relative to other cycle phases, and previous research on physical markers of genetic quality (i.e. attractiveness) has supported these theories. Here we argued that women who are paired with high quality mates (good pair-bonders) would find it too costly to cheat on those mates and we found that women who are in high quality relationships have better feelings about their relationships and partner at fertility than women paired with men who form lower quality pair bonds, and that these differences are more pronounced at fertility than at other times. We also showed that physical attractiveness is not linked to the quality of the relationship, and that attractiveness and relationship quality exert independent but analogous effects on the nature of ovulatory shifts in feelings about relationships. Our findings suggest that the quality of the pair bond is as important in predicting ovulatory extra pair interest as the attractiveness of the partner. This in turn suggests that these men who form good pair bonds may be valued as sires for offspring (i.e., for their "good genes") analogous to the way that women value men with markers of high physical quality.

This assertion counters contemporary thinking about good-genes sexual selection, which posits that the fittest males enjoy the highest reproductive success, and thus are sought out as the 'best" mates (cite). The finding that women in good pair bonds are less inclined to infidelity is not only consistent with a high cost for infidelity, but also fits with the argument that men who form high quality pair bonds may be valued because good pair-bonding genes are intrinsically genetically valuable. We have already noted

that that the majority of children born to pair-bonded women are sired by their mother's pair-bonded mate (about 90% according to Geary, Vigil, & Bird-Craven, 2004) and that males who form high quality pair bonds experience lower rates of infidelity compared to men who form poor pair bonds (Drigotas, Safstrom, & Gentilia, 1999). Taken together, this suggests that males who pair bond are typically reproductively successful. If this is true, then women in high quality pair bonds who cheat with a more attractive male would only trade off a genetic attractiveness advantage against a genetic pair-bonding advantage for their offspring.

It must be noted here that audiences to this assertion have previously objected to equating genetic predisposition toward pair bonding with a genetic propensity for attractiveness, protesting that pair-bonding is situational and learned, and therefore not genetically specified. However, evolutionary theory has long argued that behaviors (like pair bonding) as well as preferences for behaviors (like a preference for a good bonder) are as mutable via natural selection as physical properties like size and attractiveness (Tooby & Comsmides, 1990). We therefore find no flaw in the idea that women may prefer the genes of men who display good bonding behaviors over those who are attractive.

In several ways, these findings build on Haselton and Gangestad's (2006) previous finding that women who valued their partner's attractiveness over his relationship investment reported less extra pair interest and less partner jealousy at fertility relative to other cycle times. First, because we examine relationship quality and attractiveness independently, rather than pit them against each other, we found that high RQ and high PA both predict better (less aversive, more positive) relationship feelings at

fertility relative to women paired with lower genetic quality men. Thus, PA and RQ are not polar opposites and mutually exclusive, but rather independent and additive properties of relationships. This underscores the need to assess them as independent dimensions in future research.

These outcomes are also consistent with the idea that the importance of partner attractiveness may have been overemphasized in previous studies of ovulatory shifts. We suspect that the emphasis on attractiveness may be a consequence of the predominance of university undergraduates as research participants. Young women at this life stage are typically either not in a relationship or are in a recently established dating relationship. We argued that long-term relationship quality may not be apparent early in a relationship because long-term stability and long-term resource investment can be unambiguously assessed only in hindsight. Thus, dating women may weight partner attractiveness as a more important indicator of "good genes" than the more subtle indicators of pair-bonding ability. In other words, upon early acquaintance a woman does not have to guess if a given man possesses attractiveness genes because they are instantly highly visible. In contrast, a mate who starts out loyal, generous, and considerate could later dissolve a relationship and thus turn out to be a poor long-term pair-bonder. So, even if good pair-bonding genes are generally preferred to attractiveness genes, early in relationships women might focus on attractiveness relative to pair-bonding quality, because if the mate eventually deserts, at least the mother ends up with attractive offspring. We might thus predict that studies including only dating undergraduates may not replicate the findings from older community samples that include women in long-standing relationships.

Although our findings suggest refinement of previous theories on the nature of ovulatory shifts, they are consistent with decades of research on romantic relationship functioning: Women who are in stable, supportive, satisfying, non-abusive relationships will be less tempted to put that relationship at risk with infidelity than women in poor quality relationships (Previti & Amato, 2004).

Our findings also extend previous research in that our outcomes buttress Hassebrauck's (2003) contention that women are more attuned to their relationships at fertility. However, this increased relationship scrutiny at fertility suggests a refinement to Thornhill's (2006) argument that women exhibit *dual sexuality*; which is a non-fertile phase focus on pair bonding and a fertility phase shift in interest toward the genetic quality of a mate. Rather, our outcomes, and particularly the patterns we found in our 3-way interactions, suggest that for pair-bonded women, pair-bonding is important *throughout* the cycle, perhaps even more so at fertility, when primarily women with poor or non-existent pair bonds increase their interest in the attractiveness of potential mates.

Finally, the direction of all of our effects is uniformly consistent with the idea that women who are either in good relationships or paired with attractive men (or both) are protected from feelings which would incline them towards infidelity at fertility, which is consistent with strategic pluralism theory (cuckoldry with a more attractive extra pair mate when fertile; Gangestad & Simpson, 2000) in that women paired with mates who exhibit "good genes" are less likely to endanger their pair bonds with infidelity (Geary & Flinn, 2001). Our contribution to this model is that men who are good pair-bonders have "good genes," regardless of their attractiveness.

Limitations and Caveats

This study has one large limitation and several smaller ones. The largest limitation is that we used a cross-sectional design for our analysis. The ovulatory shift is a within-subjects phenomenon, and our between-subjects data do not allow us to rule out some alternative hypotheses that are also consistent with our data. As one example, it is possible that women's reports of spousal abuse are influenced by their cycle phase. In other words, fertile women who feel negative about their partners may increase their reports of their mate's abuse, or they may experience increased abuse, or experience increased salience of abuse, all of which would be consistent with the effects we observed. However, the fact that few main effect differences were observed between fertile and non-fertile women serves to allay general concerns about cycle status group differences as third variable explanations for our findings.

A related limitation arises from the absence of reports from spouses, whose separate reports could help untangle cycle effects on reported experience from the actual behaviors and situations that are being reported. It will be important to examine cycle phase impact on a woman's reports of partner attributes in conjunction with her partner's reports of his behavior, and this can only be examined in a within-subjects design that includes both couple members.

It should also be noted that we reported outcomes that we re-estimated after removing a case which showed unacceptably large influence scores in our models. This woman was physically abused by her partner, and had only been in her dating relationship one month. However, the fact that her experience was so different from the other women in our study suggests that our outcomes may not extend to women

embarking on new romantic relationships, especially abusive ones. This is also consistent with our previous speculation that our findings may not replicate in samples of women in new and less committed relationships. In fact, the attractiveness data we had was only for women who had been in their relationships for at least four years, and therefore our conclusions may be generalizable only to women who are in somewhat more established pair bonds. Here again, additional future study should examine whether, and if so, how cycle effects change as women move into increasingly committed relationships.

Another limitation is that some of our measures were not ideally suited to testing our theory. Our measure of subjective financial impact is a single self-report item that does not adequately index either the extent or the scope of a man's investment in his relationship and family. For example, a mate may help with domestic chores and provide child care, companionship, protection, and handy-man activities. These are valued by women in much the same way that income contributions are valued (DeMaris, 2007). However, the fact that similar results were obtained across all of our measures of relationship quality diminishes this particular concern.

Finally, we had no objective measures of partner attractiveness, and we do not know if the link between objective attractiveness and partner-rated attractiveness shifts with cycle phase or relationship quality. However, the fact that prior studies typically use only measures of objective attractiveness yet obtained similar effects not only reflects positively on the validity of our measures but also on the robustness of this phenomenon.

Conclusion

Our findings serve as a tantalizing beginning to understanding how pair bonding quality can impact an ovulatory shift in relationship feelings. But the best way to study

this phenomenon is by tracking both members of a substantial number of couples across several fertility cycles, and simultaneously measuring relationship feelings, behaviors, hormone levels, and cycle phase in both partners. And given the evidence we present here that pair bonding quality impacts an ovulatory shift in relationship feelings, further research can only contribute to better understanding of romantic relationship functioning, which in turn may inform therapies and interventions aimed at relationship well-being.

And despite the limitations of this study, we can conclude that our data are consistent with the culturally valued idea that a woman can value and be loyal to a man who is a committed and investing long-term romantic partner, regardless of his physical attractiveness.

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Endnotes

[1] Although measures of ambivalence show substantial correlations with measures of conflict ($r \sim .55$ in Thompson & Holmes, 1996; $r \sim .65$ in Priester & Petty, 1996) the two nonetheless predict different outcomes (Ito, Larsen, Smith, & Cacioppo, 1998; Thompson & Holmes, 1996). These findings support the argument that ambivalence, conceptualized as simultaneous distinct positive and negative feelings, is not a measure of conflicted or mixed feelings, but rather a measure of the extent to which an individual is consciously aware of separate positive and negative thoughts and feelings toward a target.

[2] We also examined a simple difference score (household income – her income), but the described measure proved superior in predicting outcomes.

[3] We had attractiveness reports on 185 of the 187 women from the T2 wave. In addition, 39 women also participated in a sub-study between T2 and T3 with their T3 partner. Women in the sub-study answered two partner attractiveness items: 1) "Relative to other people his age, how would you rate partner name's physical attractiveness?" answered on a scale 1 = much worse than average to 9 = much better than average, and 2) "Partner-name is good looking and attractive" was rated from 1 = strongly disagree to 6 = strongly agree. These responses were first weighted to align the highest ratings with the 7 point scales above (by multiplying by 7/9 and 7/6 respectively), and then combined with their other ratings. In total, 12 women had four pairs of ratings (3 ratings at T2 and 1 from the sub-study); 81 women had three pairs of ratings; 54 women had two ratings; and 40 had one rating (38 from T2, 2 from the sub-study).

Table 1. Descriptive statistics, reliabilities, and bivariate correlations among relationship quality measures.

Measure	Relationship Status	Financial Influence	Income Proportion	Abuse	Satisfaction Commitment
Relationship Status	-				
Financial Impact	**.46*****	-			
Income Proportion	**.54*****	**.43*****	-		
Abuse (reversed)	**.14***	.05	**.13***	-	
Satisfaction/ Commitment	**.20*****	**.15****	**.19****	**.24*****	-
Fertility	.01	.00	.08	.07	.02
Mean	2.86	3.25	0.37	1.11	6.04
Standard Deviation	1.21	1.50	0.32	0.53	1.19
Min – Max	1 – 4	1 - 5	0 - 1	1 - 6	1 - 7

Note: n = 353, ^{t} $p < .10$, * $p < .05$.** $p < .01$, *** $p < .001$.

[c] Single item measure.

Table 2. Descriptive statistics, reliabilities, bivariate correlations, and partial correlations[a] among relationship feelings measures.

Relationship Feelings	Positive	Negative	Ambivalent	Conflicted
Negative Feelings	**-.75*****			
Ambivalent Feelings	**-.62*****	**.83*****		
Conflicted Feelings	**-.63*****	**.76*****	**.67*****	
Fertility	.07	-.05	-.03	-.01
Mean (SD)	7.62 (1.67)	2.66 (1.84)	-.42 (2.37)	2.88 (2.13)
Min – Max	1 – 9	1 - 9	-3 – 6.75	1 - 9
α reliability	.86	.88	.82	.89

Note: n = 353. *** $p < .001$

[a]covariates were age, race, relationship duration.

Table 3. Bivariate correlations between relationship quality measures and relationship feeling outcomes.

	Relationship Feeling Outcomes			
	Positive	Negative	Conflicted	Ambivalent
Relationship Status	**.15****	**-.16****	**-.22*****	**-.17****
Financial Influence	**.11***	-.03	**-10**^{t}	-.02
Income Proportion	.08	**-.14****	**-.17****	**-.14***
Abuse (reversed)	.09	**-.13***	**-.10**^{t}	-.02
Satisfaction/Commitment	**.76*****	**-.78*****	**-.65*****	**-.56*****

Note: n = 353, $^{t}p < .10$, $^{*}p < .05$.$^{**}p < .01$, $^{***}p < .001$.

Table 4. Regression Betas for the Fertility X Relationship status interaction term predicting negative, ambivalent, conflicted, and positive relationship feelings.

	Relationship Feeling Outcomes			
	Negative	Ambivalent	Conflicted[a]	Positive
Relationship Status	**-.10^{t}**	**-.12***	-.07	.07
Male Income Proportion	-.05	-.05	-.00	-.00
Financial Influence	**-.13***	**-.14***	**-.11^{t}**	.05
Physical Abuse	**-.18****	**-.17****	-.09	**.16****
Satisfaction/Commitment	-.04	**-.14****	-.04	.02

Note: n = 353. ^{t} $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$ [a] Includes race as a covariate entered in step 1.

Table 5. Bivariate correlations between RQ and feeling outcomes, and partial correlations between RQ and relationship feeling outcomes controlling for PA in the subset of 187 women with PA ratings.

Bivariate correlations between RQ and feelings:

	Relationship Feeling Outcomes			
	Positive	Negative	Conflicted	Ambivalent
Relationship Status	.10	**-.12**^{t}	**-.18***	**-.18***
Financial Influence	.05	.07	.02	.03
Income Proportion	.02	**-.12**^{t}	-.11	**-.16***
Abuse (reversed)	.06	-.09	-.08	-.05
Satisfaction/Commitment	**.73*****	**-.78*****	**-.63*****	**-.62*****

Partial correlations between RQ and feelings controlling for PA:

	Relationship Feeling Outcomes			
	Positive	Negative	Conflicted	Ambivalent
Relationship Status	.10	**-.15***	**-.20****	**-.22****
Financial Influence	.05	.05	.01	.02
Income Proportion	.03	**-.14***	**-.13**^{t}	**-.18***
Abuse (reversed)	.10	**-.15***	-.12	-.11
Satisfaction/Commitment	**.73*****	**-.80*****	**-.63*****	**-.62*****

Note: n = 187, $^{t}p < .10$, $^{*}p < .05$.$^{**}p < .01$, $^{***}p < .001$.

Table 6. Comparison of Interaction Betas for RQ X fertility interactions when RQ is estimated separately vs. together with PA X fertility interactions in a combined model. All parameters were estimated in the subset of 187 women with PA ratings.

Relationship Status	Relationship Feelings			
	Negative	Ambivalent	Conflicted	Positive
Relstat by Fertility est. alone	**-.14** ^{t}	**-.16** *	**-.16** ^{t}	.09
Relstat by Fertility est. together	-.09	**-.17** *	-.13	.10
PA by Fertility est. together	-.15	-.10	**-.24** **	.06
Male Income Prop				
MI% by Fertility est. alone	-.04	-.10	-.09	-.01
MI% by Fertility est. together	-.13	-.07	.04	-.03
PA by Fertility est. together	-.02	**-.15** ^{t}	**-.28** **	.10
Financial Influence				
FinInf by Fertility est. alone	**-.16** ^{t}	**-.20** *	**-.19** *	.01
FinInf by Fertility est. together	-.12	**-.17** *	-.14	.09
PA by Fertility est. together	-.14	-.13	**-.27** **	-.01
Satisfaction/Commitment				
Satcom by Fertility est. alone	-.03	**-.16** *	**-.14** *	-.01
Satcom by Fertility est. together	-.02	**-.15** *	-.11	-.00
PA by Fertility est. together	-.03	-.05	**-.18** **	-.00

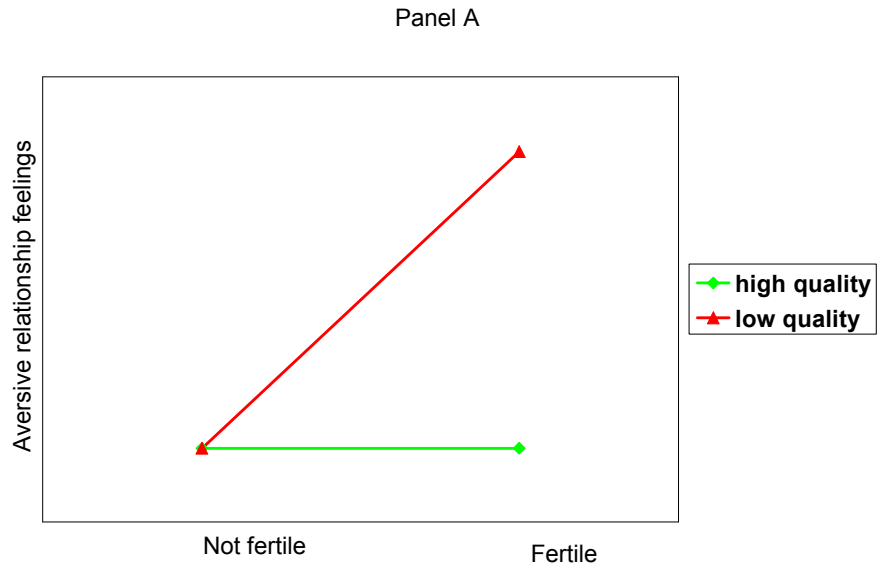
Note: ^{t} $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$ [a] Includes race as a covariate entered in step 1.

Table 6. Regression Betas for 3-way interactions (step 3) with Relationship Quality (RQ) and Partner Attractiveness (PA) moderating fertility shifts in negative, ambivalent, conflicted, and positive relationship feelings.

	Relationship status		Male Income Proportion		Financial influence		Satisfaction Commitment	
Predictor	ΔR^2	β	ΔR^2	β	ΔR^2	β	ΔR^2	β
DV = Negative feelings								
Step 3	.00		**.02**^{t}		**.02**^{t}		.00	
3-way interaction		.09		**.18**^{t}		**.17**^{t}		.03
DV = Ambivalent feelings								
Step 3	.00		**.03***		.01		.00	
3-way interaction		.07		**.20***		.15		.03
DV = Conflicted feelings [a]								
Step 3	**.02***		.**04****		**03***		.00	
3-way interaction		**.21***		**.26****		**.23***		.02
DV = Positive feelings								
Step 3	.03		.01		.01		.00	
3-way interaction		-.08		.03		-.15		.00

Note: ^{t} $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$ [a] Includes race as a covariate entered in step

Figure 1.


Panel A
Aversive relationship feelings
high quality
low quality
Not fertile
Fertile

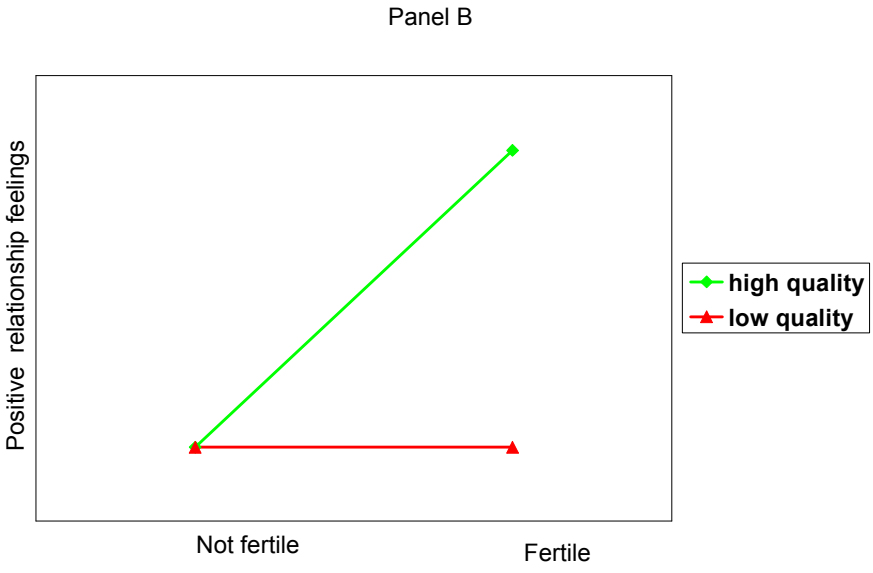

Panel B
Positive relationship feelings
high quality
low quality
Not fertile
Fertile

Figure 2.

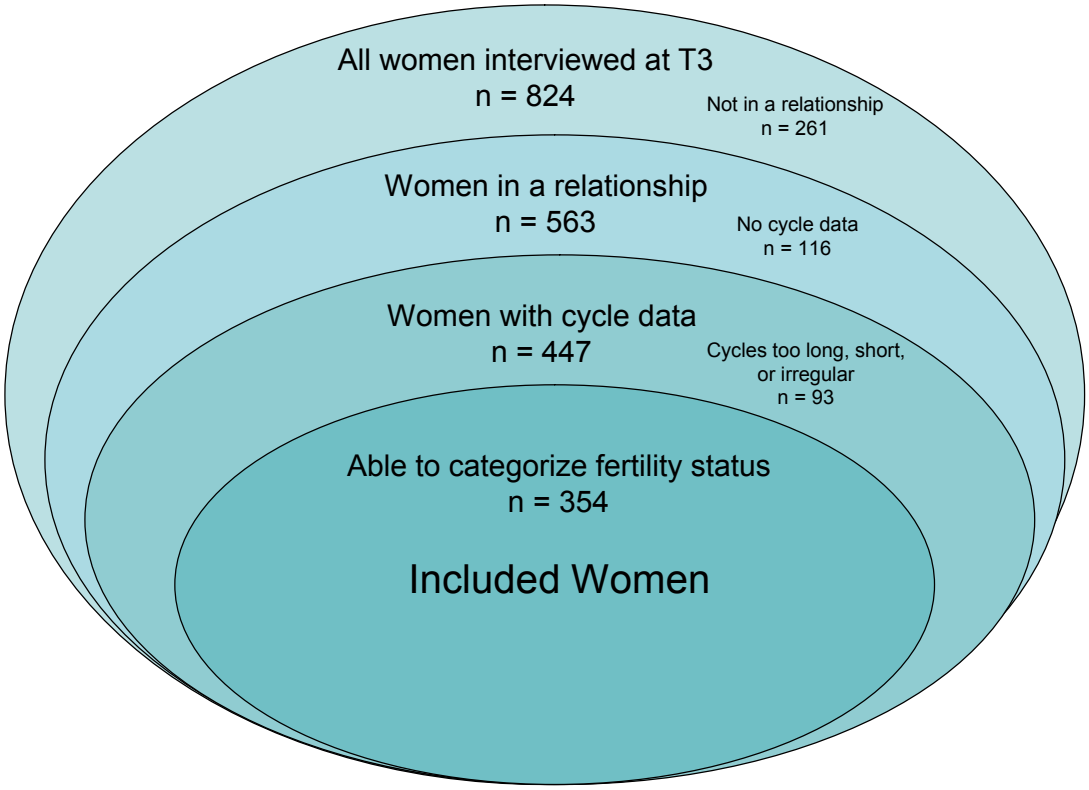
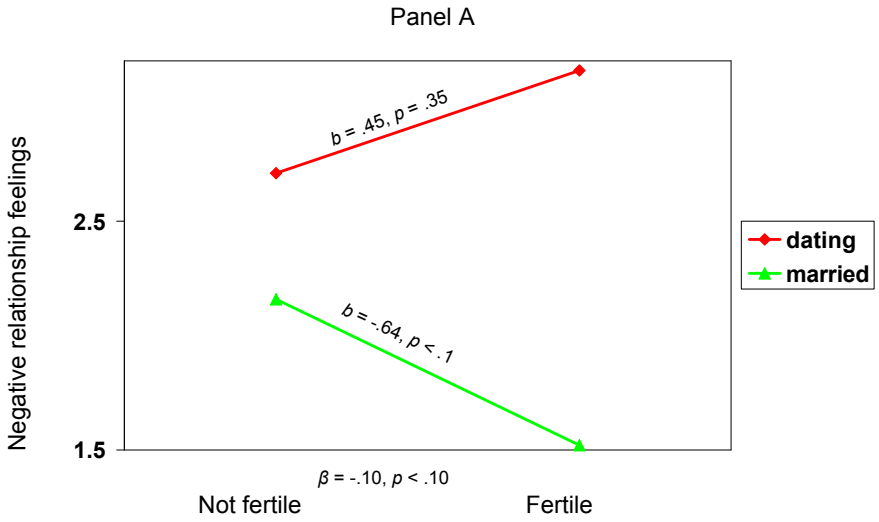
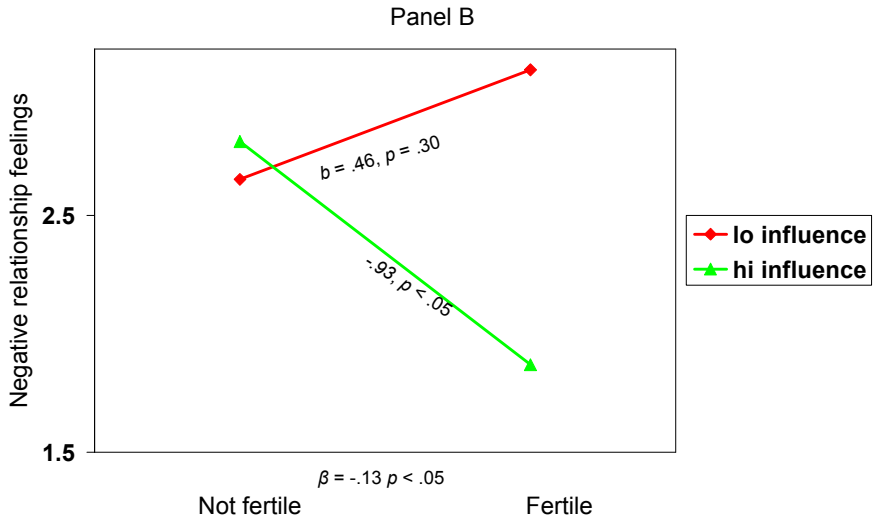

All women interviewed at T3
n = 824
Not in a relationship
n = 261
Women in a relationship
n = 563
No cycle data
n = 116
Women with cycle data
n = 447
Cycles too long, short,
or irregular
n = 93
Able to categorize fertility status
n = 354
Included Women

Figure 3.


Panel A
Negative relationship feelings
2.5
1.5
b = .45, p = .35
b = -.64, p < .1
dating
married
β = -.10, p < .10
Not fertile
Fertile


Panel B
Negative relationship feelings
2.5
1.5
b = .46, p = .30
-.93, p < .05
lo influence
hi influence
β = -.13 p < .05
Not fertile
Fertile

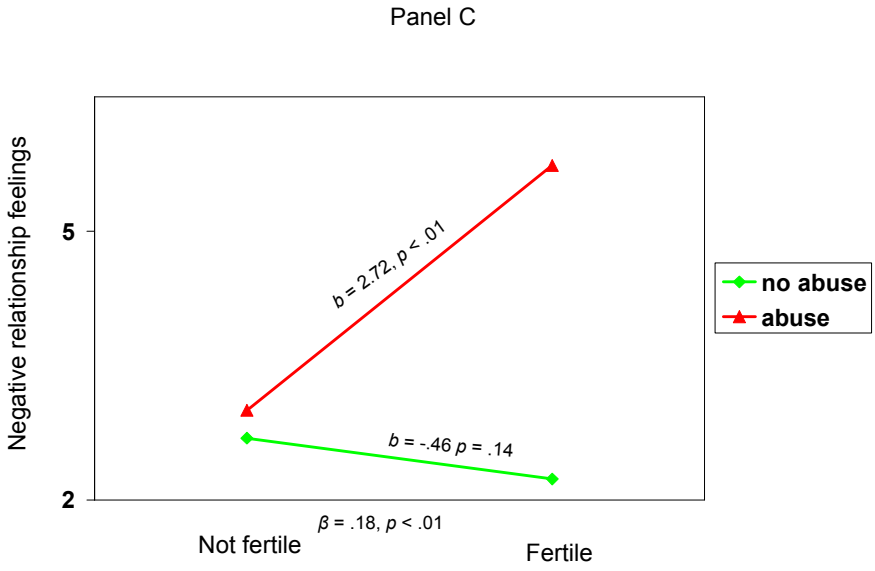

Panel C
Negative relationship feelings
5
2
b = 2.72, p < .01
b = -.46 p = .14
β = .18, p < .01
Not fertile
Fertile
no abuse
abuse

Figure 4.

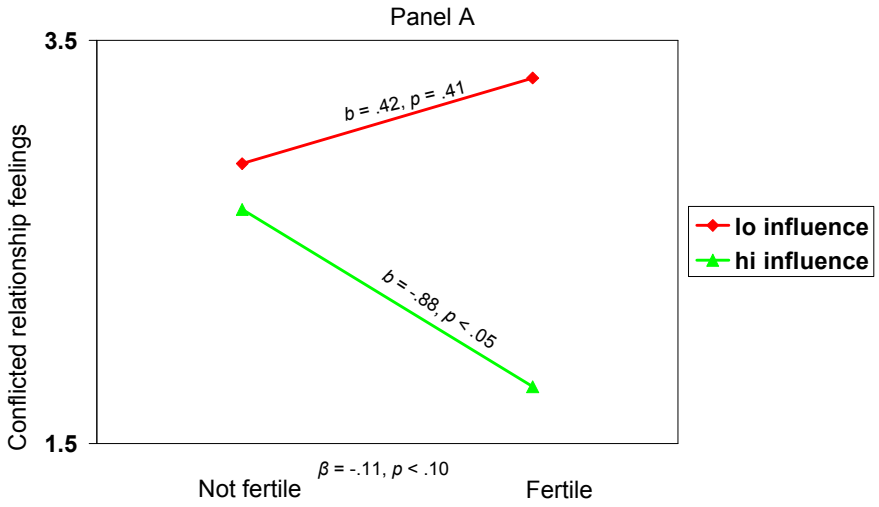
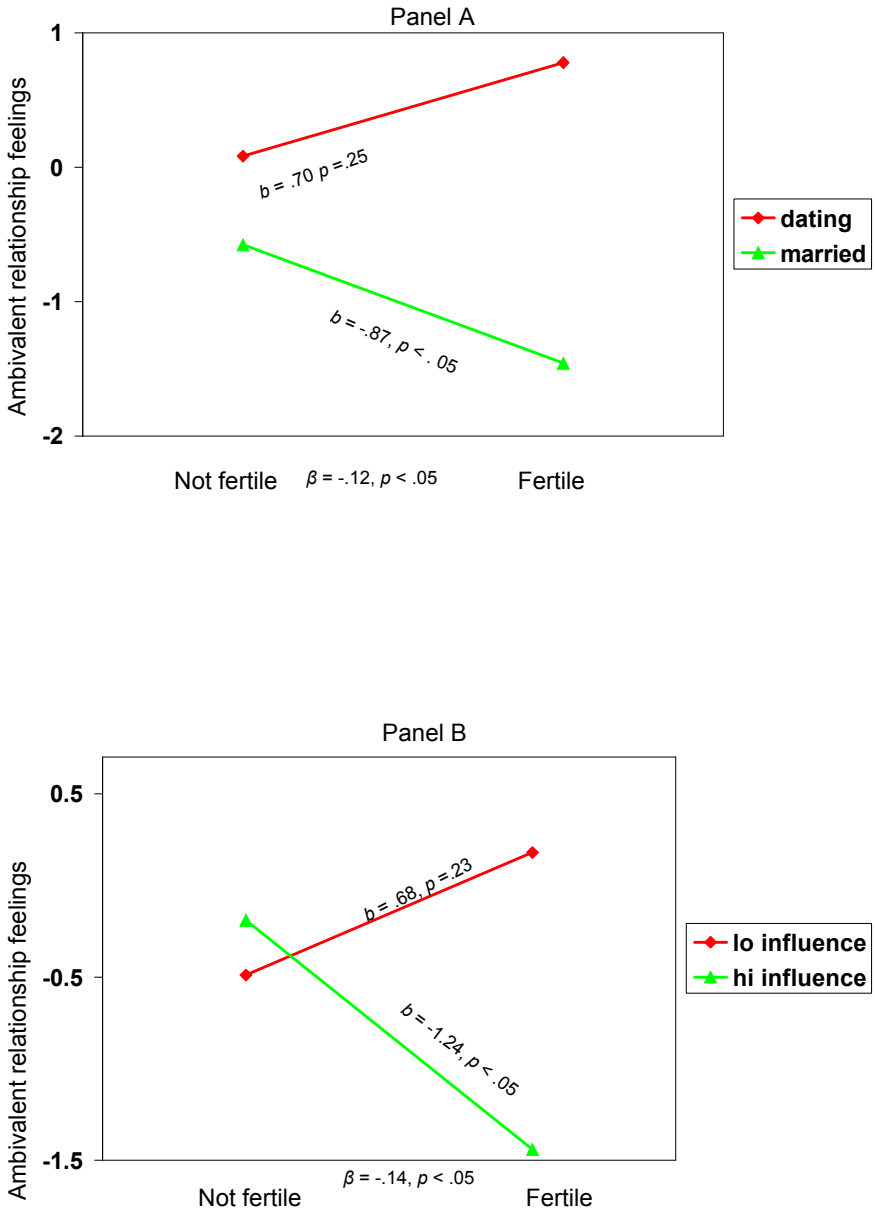
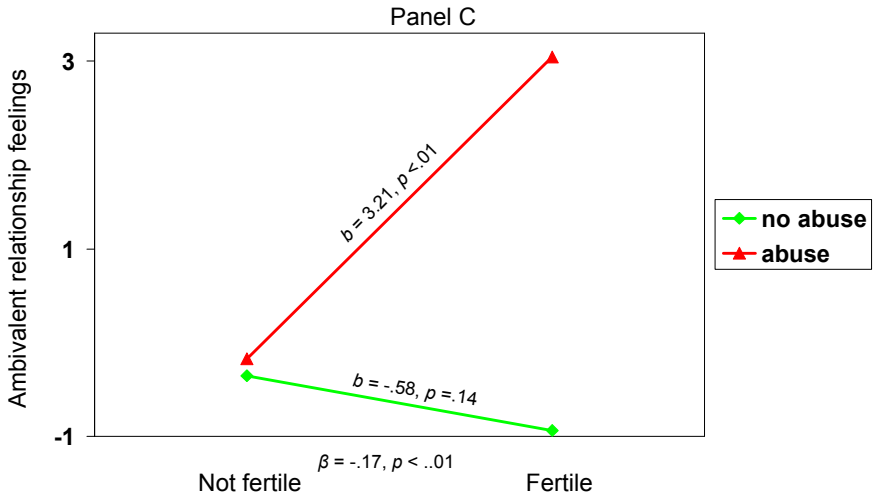

Panel A
3.5
1.5
Conflicted relationship feelings
b = .42, p = .41
b = -.88, p < .05
lo influence
hi influence
β = -.11, p < .10
Not fertile
Fertile

Figure 5.


Panel A
Ambivalent relationship feelings
1
0
-1
-2
b = .70 p =.25
b = -.87, p < . 05
dating
married
Not fertile
β = -.12, p < .05
Fertile
Panel B
Ambivalent relationship feelings
0.5
-0.5
-1.5
b = .68, p =.23
b = -1.24, p < .05
lo influence
hi influence
β = -.14, p < .05
Not fertile
Fertile


Panel C
Ambivalent relationship feelings
3
1
-1
b = 3.21, p <.01
b = -.58, p =.14
β = -.17, p < ..01
Not fertile
Fertile
no abuse
abuse

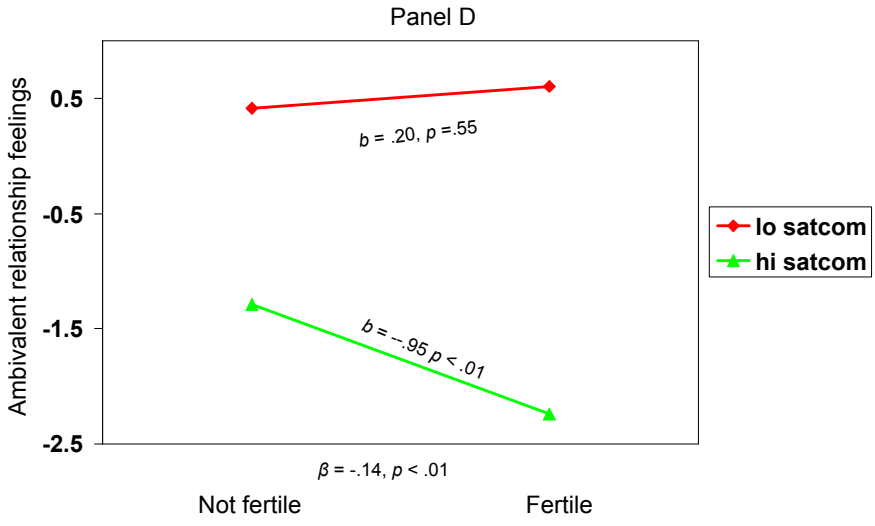

Panel D
Ambivalent relationship feelings
0.5
-0.5
-1.5
-2.5
b = .20, p =.55
b = -.95 p < .01
β = -.14, p < .01
Not fertile
Fertile
lo satcom
hi satcom

Figure 6.

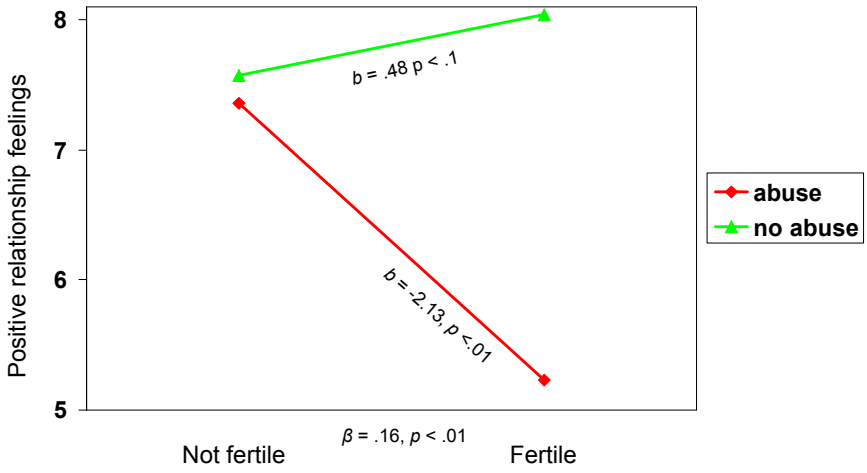
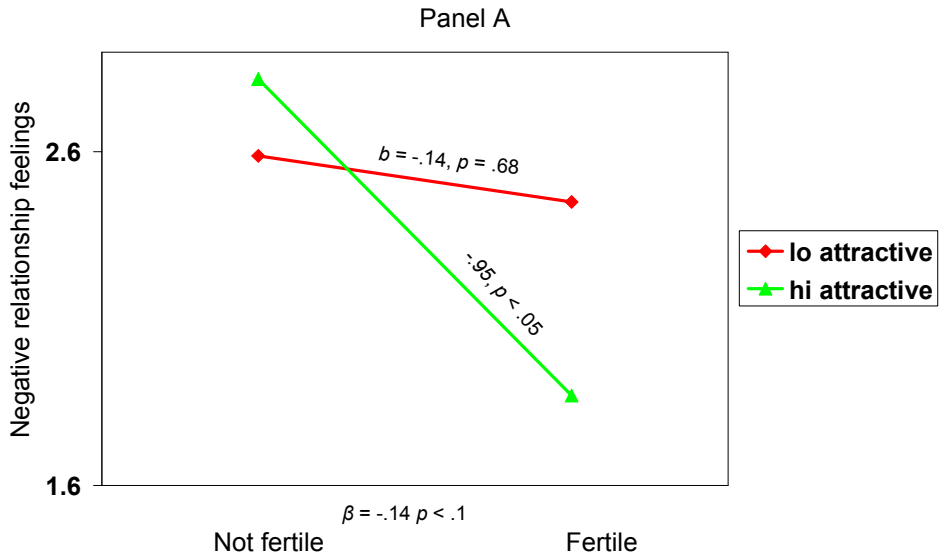
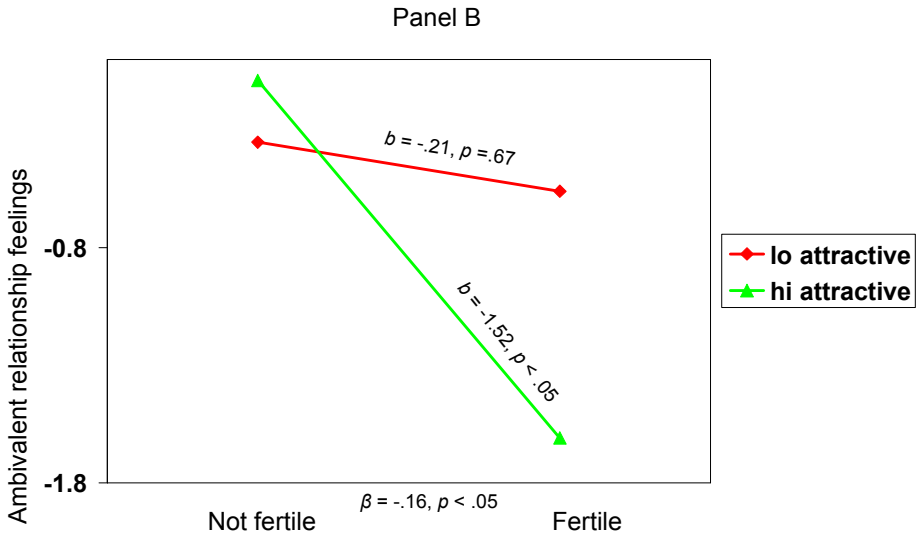

8
7
6
5
Positive relationship feelings
b = .48 p < .1
b = -2.13, p < .01
abuse
no abuse
β = .16, p < .01
Not fertile
Fertile

Figure 7.


Panel A
Negative relationship feelings
2.6
1.6
b = -.14, p = .68
-.95, p < .05
lo attractive
hi attractive
β = -.14 p < .1
Not fertile
Fertile


Panel B
Ambivalent relationship feelings
-0.8
-1.8
b = -.21, p =.67
b = -1.52, p < .05
lo attractive
hi attractive
β = -.16, p < .05
Not fertile
Fertile

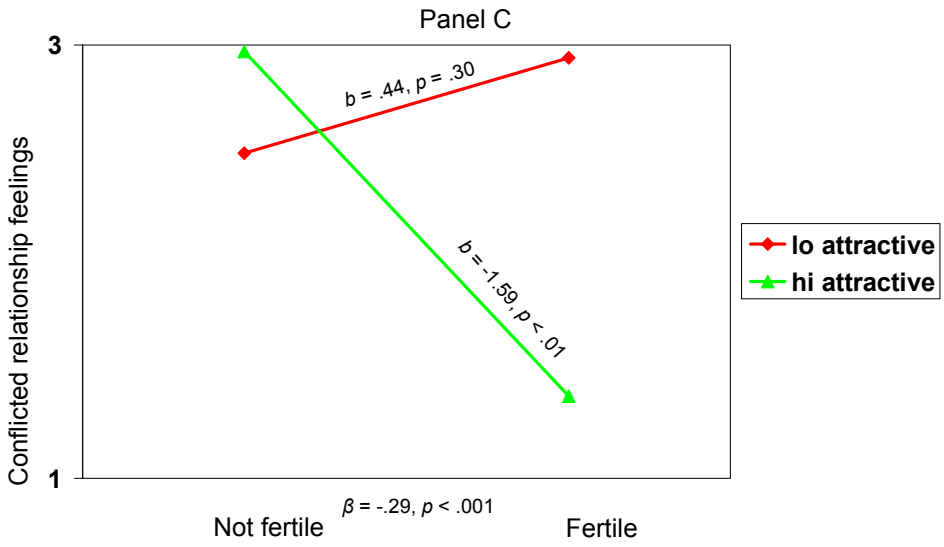
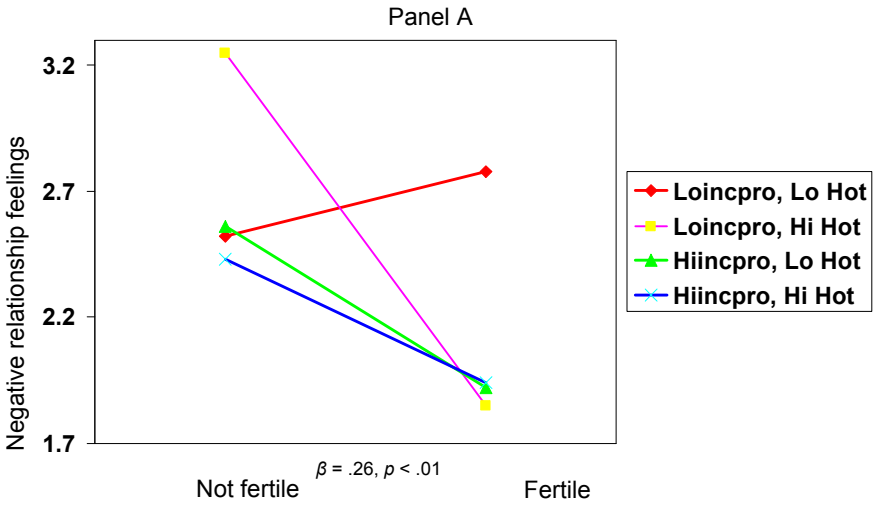
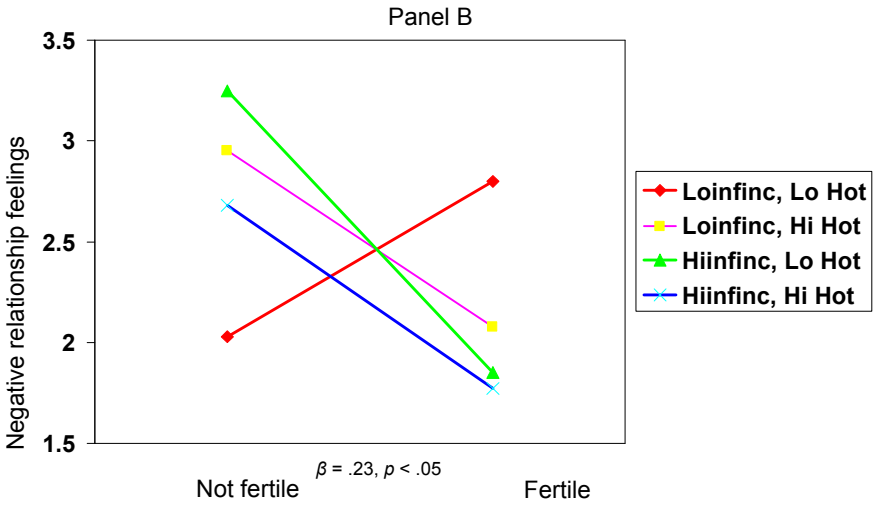
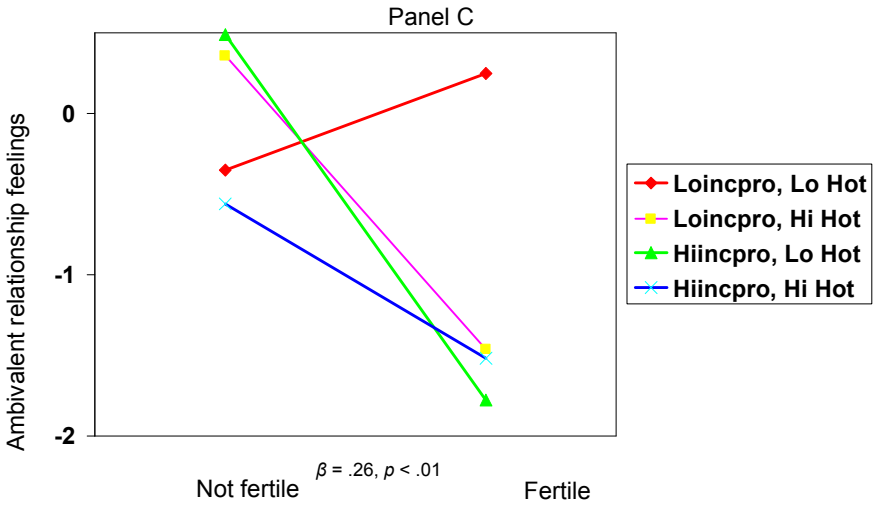
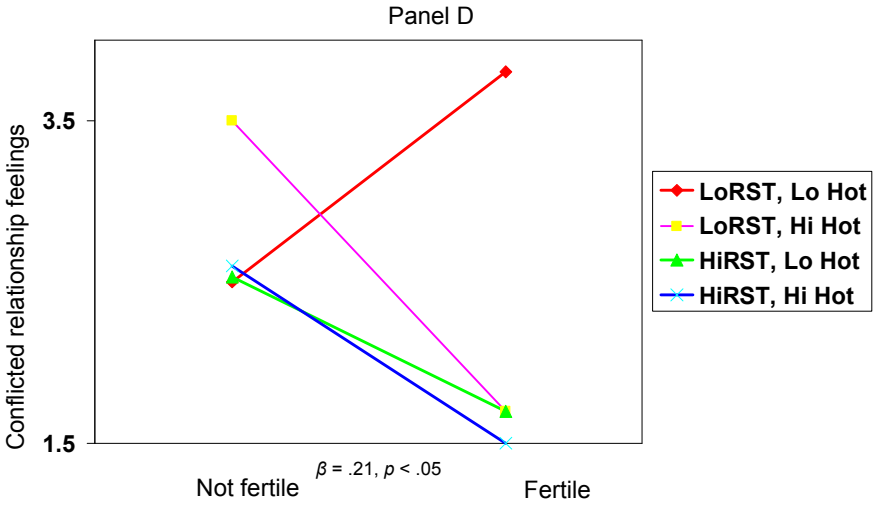

Panel C
3
1
Conflicted relationship feelings
b = .44, p = .30
b = -1.59, p < .01
lo attractive
hi attractive
β = -.29, p < .001
Not fertile
Fertile

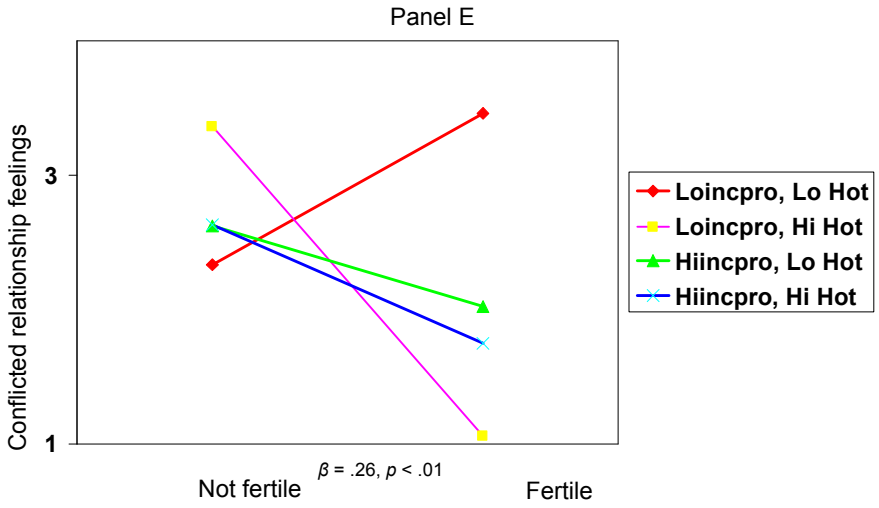
Figure 8.

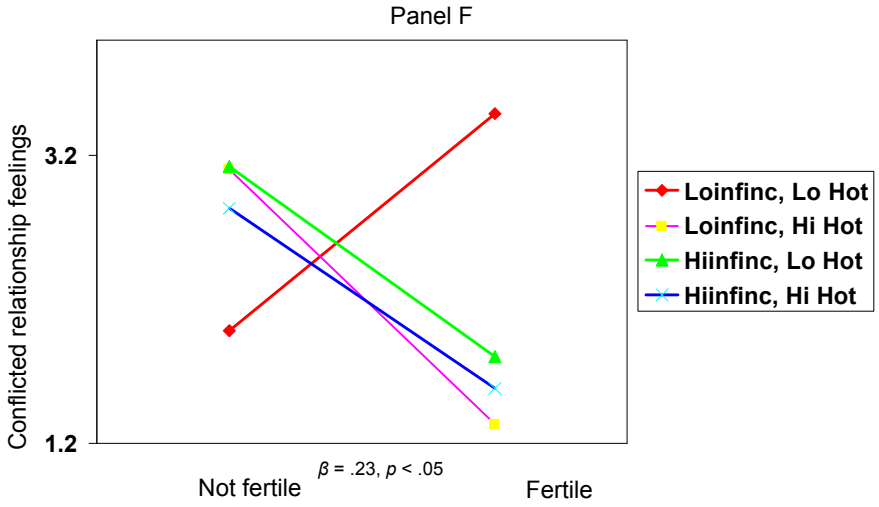

Panel A
Negative relationship feelings
3.2
2.7
2.2
1.7
β = .26, p < .01
Not fertile
Fertile
Loincpro, Lo Hot
Loincpro, Hi Hot
Hiincpro, Lo Hot
Hiincpro, Hi Hot


Panel B
Negative relationship feelings
3.5
3
2.5
2
1.5
β = .23, p < .05
Not fertile
Fertile
Loinfinc, Lo Hot
Loinfinc, Hi Hot
Hiinfinc, Lo Hot
Hiinfinc, Hi Hot


Panel C
Ambivalent relationship feelings
0
-1
-2
β = .26, p < .01
Not fertile
Fertile
Loincpro, Lo Hot
Loincpro, Hi Hot
Hiincpro, Lo Hot
Hiincpro, Hi Hot


Panel D
Conflicted relationship feelings
3.5
1.5
β = .21, p < .05
Not fertile
Fertile
LoRST, Lo Hot
LoRST, Hi Hot
HiRST, Lo Hot
HiRST, Hi Hot


Panel E
Conflicted relationship feelings
3
1
β = .26, p < .01
Not fertile
Fertile
Loincpro, Lo Hot
Loincpro, Hi Hot
Hiincpro, Lo Hot
Hiincpro, Hi Hot


Panel F
Conflicted relationship feelings
3.2
1.2
β = .23, p < .05
Not fertile
Fertile
Loinfinc, Lo Hot
Loinfinc, Hi Hot
Hiinfinc, Lo Hot
Hiinfinc, Hi Hot

Vita

Melanie Sheldon earned a Bachelor's degree in Biomedical Engineering at Duke University in 1981. She chose psychological research as her third "career" after lengthy and enjoyable forays into failure analysis engineering and secondary school teaching. Married to a personality psychologist and raising three children, she somehow managed to eke out this dissertation while juggling teaching, research, and running a busy household.