Evolutionary Behavioral Sciences
2017, Vol. 11, No. 2, 161–172

2330-2925/17/$12.00 http://dx.doi.org/10.1037/ebs0000083

Wives With Masculine Husbands Report Increased Marital Satisfaction Near Peak Fertility

Andrea L. Meltzer
Florida State University

Although masculine men offer good genes, they tend to be less willing to invest in long-term relationships. Perhaps for this reason, women demonstrate a shift in their preference for partner masculinity near peak fertility—when they are best able to capitalize on such genetic benefits. Nevertheless, little is known about the extent to which such shifts interact with the masculinity of one's partner in the context of a long-term relationship. Given that relationship satisfaction may act as a barometer that gauges the extent to which people meet the evolved needs of their long-term relationships, the current study of 70 newlywed couples tested the notion that the association between wives' conception risk and their marital satisfaction would depend on their husbands' self-reported masculinity. Consistent with predictions, conception risk was positively associated with marital satisfaction among normally cycling wives with relatively more masculine husbands but unassociated with marital satisfaction among normally cycling wives with relatively less masculine husbands. These findings demonstrate that women's short-term mating strategies interact with their partners' genetic qualities to impact women's satisfaction with even their most long-term relationships—their marriages.

Keywords: marital satisfaction, partner masculinity, ovulation, long-term relationships, fertility

Masculine traits reflect numerous qualities that confer reproductive benefits to men. Perhaps because women perceive men with more masculine physical characteristics as being more physically attractive (Feinberg et al., 2006; Puts, 2005) and healthier (Folstad & Karter, 1992; Rhodes, Chan, Zebrowitz, & Simmons, 2003; Thornhill & Gangestad, 2006) than men with less masculine physical characteristics, masculine men report obtaining more mates (Rhodes, Simmons, & Peters, 2005) and even reproduce at a greater rate in modern hunter–gatherer societies (Apicella, Feinberg, & Marlowe, 2007). Accordingly, ancestral women could have gained access to good genes to the extent that they obtained highly masculine mates (Gangestad, Garver-Apgar, Simpson, & Cousins, 2007; Thornhill & Gangestad, 1999).

Nevertheless, there are also reproductive costs associated with choosing such mates. Not only do masculine men face various health risks (Booth, Johnson, & Granger, 1999; Getty, 2002; Møller, Christe, & Lux, 1999) but the partners of such men risk low levels of parental investment. Indeed, whereas relatively more masculine men are more likely to pursue short-term mating strategies compared to long-term mating strategies and thus are less likely to commit to and invest in a single partner, relatively less masculine men are more likely to pursue long-term mating strategies (Booth & Dabbs, 1993; Gangestad & Simpson, 2000; Gray, Parkin, & Samms-Vaughan, 2007; Roney, Hanson, Durante, & Maestripieri, 2006; van Anders & Goldey, 2010; van Anders, Hamilton, & Watson, 2007). Thus, although masculine men offer the benefit of good genes, such benefits may come at the cost of low levels of

This article was published Online First October 27, 2016.
The author would like to thank Kaitlinh Cai, Claire Dawson, Julianna Fischer, Kaitlyn Kaiser, Victoria McKay, Justin Stafford, and Avery Trent for their assistance in data collection and data entry. The author would also like to thank James McNulty for his helpful comments on a draft of this article.

Correspondence concerning this article should be addressed to Andrea L. Meltzer, Department of Psychology, Florida State University, 1107 West Call Street, Tallahassee, FL 32306. E-mail: meltzer@psy.fsu.edu

investment—a particularly harmful cost for ancestral women (Trivers, 1972).

Consequently, women may have been forced to make trade-offs in mate selection—choosing between mates with indicators of genetic fitness and mates with indicators of the willingness to invest (Buss & Shackelford, 2008; Gangestad & Simpson, 2000). Accordingly, scholars have argued that ancestral women may have evolved a mixed-mating strategy whereby they adopted a long-term mating strategy to obtain mates who were willing and able to invest in offspring yet also a short-term mating strategy to obtain mates with qualities indicative of genetic fitness near ovulation (Gangestad, Thornhill, & Garver-Apgar, 2010a; Pillsworth & Haselton, 2006). Consistent with this idea, research has indicated that women demonstrate a stronger preference for masculinity near peak fertility, when they could gain genetic benefits for their offspring, compared to less-fertile phases of their menstrual cycles (Gangestad, Thornhill, & Garver-Apgar, 2010b).

But what are the implications of this strategy for women's long-term relationships? One possibility that follows directly from this mixed-mating strategy is that partnered women are more likely to seek masculine extra-pair mates near ovulation. Indeed, Gangestad and colleagues (2010b) demonstrated that partnered women displayed greater interest in masculine extra-pair mates near peak fertility compared to less-fertile phases of their menstrual cycles, particularly to the extent that they did not have masculine partners. Specifically, fertile women paired with relatively less masculine partners display more interest in masculine extra-pair mates than do fertile women paired with relatively more masculine partners (Gangestad et al., 2010b; also see Gangestad, Thornhill, & Garver-Apgar, 2005; Haselton & Gangestad, 2006; Larson, Pillsworth, & Haselton, 2012).

The Role of Relationship Satisfaction

Relationship satisfaction may be the proximate mechanism that motivates women's interest in extra-pair mates. Indeed, one of the strongest predictors of forming and staying in a relationship is satisfaction with that relationship (Karney & Bradbury, 1995; Kelley & Thibaut, 1978; Rusbult, 1980; Stanley & Markman, 1992). Accordingly, any adaptation that operates to help women form and stay in relationships that are reproductively advantageous may do so by affecting their satisfaction with that relationship (for a related discussion, see Li & Meltzer, 2015; Meltzer, McNulty, Jackson, & Karney, 2014a; Shackelford & Buss, 1997). Indeed, decreased relationship satisfaction is one important predictor of extra-pair mating (Atkins, Baucom, & Jacobson, 2001; McNulty & Widman, 2014). Thus, the goal of the current study was to examine whether mated women's conception risk similarly interacts with their partner's masculinity to predict their relationship satisfaction.

There is existing research addressing this issue. In two studies, Larson, Haselton, Gildersleeve, and Pillsworth (2013) demonstrated that women who rated their long-term partners relatively high in sexual desirability reported higher relationship quality (i.e., closeness and satisfaction) at peak fertility—just prior to ovulation—compared to less-fertile days of their menstrual cycles. Nevertheless, given that the studies assessed women's perceptions of their partners' qualities rather than their partners own reports of their qualities, it remains unclear whether it is indeed those partners' qualities that influence women's long-term relationship outcomes or some third variable associated with women's perceptions that influence their long-term relationship outcomes. Indeed, women's perceived partner sexual desirability likely reflects numerous partner qualities, and thus it is important to examine the specific partner qualities (e.g., masculinity) that may drive such effects.

Methodological and Measurement Issues

Most prior research examining the reproductive benefits associated with men's masculinity has operationalized masculinity using men's physical characteristics. For example, existing studies have examined women's preferences for and the implications of men's facial masculinity (e.g., Boothroyd, Jones, Burt, & Perrett, 2007; DeBruine et al., 2006; Gangestad et al., 2010b; Kruger, 2006; Thornhill & Gangestad, 2006), body masculinity (e.g., Little, Jones, & Burriss, 2007), and low voice pitch (e.g., Apicella et al., 2007; Feinberg et al., 2006; Puts, 2005). Yet an often-overlooked operationalization of mascu-

linity is men's masculine behavioral displays, such as dominance and assertiveness. Indeed, some scholars have argued that such behavioral displays may be an even stronger indicator of masculinity than are men's physical characteristics (see Gangestad, Simpson, Cousins, Garver-Apgar, & Christensen, 2004). Accordingly, the current study examined whether women's long-term partners' behavioral displays of masculinity interact with women's fertility to predict their relationship satisfaction.

Given that the specific prediction and theoretical framework pertain to women's reactions to partner masculinity in the context of a long-term-oriented relationship, it is also crucial that participants be involved in long-term relationships. Although dating couples who are involved in long-term relationships would certainly provide a fair test of the interactive effects of women's fertility and their partners' behavioral masculinity for women's relationship satisfaction, the problem with most existing studies of dating couples is that it is unclear whether such couples adopt long-term or short-term relationship orientations. Thus, as others have argued (Li & Meltzer, 2015; Meltzer et al., 2014a), utilizing a sample of married couples is one way to maximize the likelihood that all couples are engaged in long-term-oriented relationships.

Overview of the Current Study

I used a daily diary study of newlywed couples to examine the interactive effects of wives' fertility and their husbands' behavioral masculinity on those wives' marital satisfaction. Every evening for two weeks, wives provided information that was used to calculate their conception risk and completed a measure of marital satisfaction, and husbands completed a measure of behavioral masculinity. I predicted that the association between changes in wives' conception risk and their marital satisfaction would depend on their husbands' level of self-reported behavioral masculinity. Whereas I expected wives married to relatively more masculine husbands to report increased marital satisfaction near peak fertility, I expected wives married to relatively less masculine husbands to report decreased marital satisfaction near peak fertility. Further, in an effort to demonstrate that this effect was driven by hormonal changes associated with ovulation, rather than other physical changes associated with the menstrual cycle, I examined whether the predicted interaction was further moderated by whether women were normally cycling (e.g., experienced a consistent menstrual cycle, not using hormonal contraceptives), expecting it to emerge among only normally cycling women.

Method

Participants

Participants were 70 first-married newlywed couples who had completed the daily diary phase of data collection in a larger study of 113 newlywed couples. The couples not included in the current analyses either (a) did not complete the daily diary phase of data collection ($n = 8$; 7%) or (b) did not provide sufficient data to estimate wives' conception risk ($n = 31$; 27%) or husbands' behavioral masculinity ($n = 4$; 4%). Data collection was initially planned for 12 months but was extended for one additional month to increase sample size.

Participants were recruited through invitations sent to eligible couples who had applied for marriage licenses in the county of the study location (North Texas). Interested couples who responded to the invitation were screened in a telephone interview to ensure they met the following criteria, given broader goals of the study: (a) they had been married for less than four months and both partners could attend a laboratory session within the first four months of their marriage, (b) neither partner had been previously married, (c) they were at least 18 years of age, and (d) they spoke English (to ensure questionnaire comprehension).

The wives analyzed here were 26.67 years old ($SD = 3.78$) and had completed 16.50 years of education ($SD = 2.51$) on average; 56% were employed full time, and 14% were full-time students. The husbands analyzed here were 27.86 years old ($SD = 4.10$) and had completed 15.84 years of education ($SD = 2.88$) on average; 74% were employed full time, and 11% were full-time students. The sample was quite diverse, relative to other samples of first-married newlywed couples (see Karney, Kreitz, & Sweeney, 2004). Forty (57.1%) wives and 39 (55.7%) husbands identified as Caucasian, 12 (17.1%) wives and 12 (17.1%) husbands identified as African American, 11 (15.7%) wives

and 12 (17.1%) husbands identified as Latina/o, six (8.6%) wives and seven (10.0%) husbands identified as an "Other" race, and one wife did not report her race.

Procedure

Following recruitment, couples completed a battery of questionnaires online at Qualtrics.com or through the mail. These included various questionnaires beyond the scope of the current analyses and one of the items necessary for utilizing the reverse-cycle method to calculate wives' conception risk: their average menstrual cycle length. Subsequent to completing these questionnaires, each member of the couple was e-mailed a link to a daily questionnaire every day for 14 days. For wives, this daily questionnaire included several additional items necessary for estimating their conception risk, including (a) their previous menstrual cycle start date and (b) whether they were normally cycling (i.e., experienced a consistent menstrual cycle and not using hormonal contraceptives), as well as their daily marital satisfaction. For husbands, this daily questionnaire included items assessing their behavioral masculinity. After the 14th day, couples were mailed a check for participating. Couples were paid $1 per person per diary day completed. As an incentive to complete more diaries, couples were paid an additional $7 if both spouses completed all 14 days. Wives completed an average of 12.34 (SD = 3.13) days, and husbands completed an average of 12.06 (SD = 3.34) days. Notably, because the analyses produced estimates for every individual in the sample, including individuals with missing data, by weighting individual estimates according to Bayes's theorem (Box & Tiao, 1973), I could include all 70 couples in the analyses.

Measures

Wives' daily conception risk estimates. Consistent with prior psychological research examining ovulation effects (e.g., Eastwick & Finkel, 2012; Haselton & Gangestad, 2006), wives reported their average menstrual cycle length at baseline and the start date of their previous menstruation at each daily assessment, which was used to (a) place women on a "standard" 29-day cycle and (b) calculate conception risk (range = .000 to .094) for each day of the 14-day diary using the reverse-cycle-day method (see Garver-Apgar, Gangestad, & Thornhill, 2008) and actuarial medical data (see Wilcox, Dunson, Weinberg, Trussell, & Baird, 2001). Higher scores indicate higher probability of conception with a single act of unprotected intercourse. Given the greater variability in women's follicular phase compared to the luteal phase, this reverse-cycle-day method is preferred over the forward-cycle-day method (Fehring, Schneider, & Raviele, 2006). Nevertheless, given recent concerns that researchers can choose whichever method of estimation provides support for their predictions (Harris, Chabot, & Mickes, 2013), I also attempted to demonstrate that the predicted effect replicated with estimates formed using the forward-cycle-day method (on the basis of only the daily self-reported start date of wives' previous menstruation; range = .000 to .086; see Garver-Apgar et al., 2008).

Normally cycling dummy code. Although I was able to calculate a "conception risk value" for all participants based on days since menstruation, that value is a meaningful indicator of conception risk among only women who experience a normal menstrual cycle (Wilcox et al., 2001). Some women do not experience a normal menstrual cycle for reasons such as pregnancy, hysterectomy, menopause, or irregularity, and women using hormonal contraceptives do not experience naturally cycling hormones associated with ovulation. Thus, wives indicated each day whether they (a) experienced a "regular menstrual cycle (i.e., their average menstrual cycle length consistently fell within 25–35 days)" and (b) used "any form of hormonal birth control—hormonal birth control includes things such as oral contraceptives (the Pill), the patch, vaginal ring (NuvaRing), implants, or injections." Both items were assessed daily because women's cycling could have changed across the 14-day diary (e.g., they may have begun using hormonal contraceptives, they may have conceived). Given that no wives reported any changes in either question across the 14 days, however, each wife was dummy-coded as either 0 (normally cycling; i.e., experiencing a regular menstrual cycle and not using hormonal contraceptives; n = 29) or 1 (nonnormally cycling; i.e., not experiencing a regular menstrual cycle due to pregnancy or irregularity and/or using hormonal contraceptives; n = 41).

I then examined this dummy code as a moderator of the predicted effect in an effort to show that any associations involving conception risk were due to fertility, which should covary with only conception risk in normally cycling women, rather than other factors that vary across the menstrual cycle (e.g., physical symptoms associated with time since previous menstruation or time until next menstruation).

Husbands' average behavioral masculinity. Each day of the 14-day diary, husbands completed four items assessing their behavioral masculinity. Specifically, at the end of each day, husbands indicated the extent to which they were dominant, powerful, masculine, and assertive that day on a 7-point scale ranging from 1 (*not at all*) to 7 (*extremely*). Because the average level of husbands' behavioral masculinity, rather than the day-to-day fluctuations in husbands' behavioral masculinity, should be a more robust measure of their trait levels of behavioral masculinity, I averaged husbands' responses to the four items across the 14 days. Higher scores indicate higher average levels of behavioral masculinity. In this study, internal consistency of this measure was adequate (α = .85), and husbands reported moderate levels of masculinity (M = 3.85), though there was substantial variability (SD = 1.19) in these reports. Moreover, husbands' scores were normally distributed (skewness = −.28, SE = .29; kurtosis = −.11, SE = .57, Kolmogorov–Smirnov statistic = .06, p = .200; Shapiro-Wilk statistic = .98, p = .479).

Daily marital satisfaction. I assessed spouses' daily marital satisfaction using a revised version of the Kansas Marital Satisfaction Scale (KMSS; Schumm, Nichols, Schectman, & Grigsby, 1983). The KMSS is a three-item scale asking spouses to report the extent to which they agree with general statements about their marriage. Specifically, spouses were asked to "reflect on the day as a whole" and indicate the extent to which they were "satisfied with their partner today," "satisfied with their relationship with their partner today," and "satisfied with their marriage today," on a 7-point scale ranging from 1 (*not at all*) to 7 (*extremely;* see McNulty & Karney, 2001). Spouses' responses were averaged, and higher scores indicated higher daily marital satisfaction. Wives' scores were used as the dependent variable in all analyses, and husbands' scores were used as a covariate in a supplemental analysis. Internal consistency of this measure was high (all αs $\geq$ .89).

Data Analytic Strategy

Given that the key predictor is changes in wives' own conception risk (i.e., within-subject differences), independent of the extent to which their average conception risk varies from the sample mean's conception risk (i.e., between-subjects differences), analyses require isolating wives' within-subject effects from their between-subjects effects. Thus, daily reports of marital satisfaction from each wife were regressed onto daily estimates of their conception risk to estimate the covariance between each wife's conception risk and daily marital satisfaction over the course of 14 days in the first level of a two-level model. Then, in the second level, husbands' average self-reported behavioral masculinity ratings were used to account for between-subjects differences in the magnitude of the within-subject covariance, controlling for all corresponding between-subjects effects, including between-subjects differences in conception risk. To accomplish these analyses in a way that additionally controlled for correlated errors across levels, I examined data with hierarchical linear modeling (HLM; Bryk & Raudenbush, 1992), implemented using the HLM 7 computer program (Bryk, Raudenbush, & Congdon, 1994). Additionally, as previously noted, I predicted that the interactive association between wives' estimated conception risk values and husbands' average masculinity would be further moderated by whether wives were normally cycling, such that it would only affect changes in daily marital satisfaction among wives who were normally cycling and thus experiencing the hormonal fluctuations associated with ovulation.

In sum, I tested the prediction by estimating the following Level-1 and Level-2 equations:

$$\begin{aligned} Y_{ij}&(\text{Wives' Marital Satisfaction}) \\ &= \pi_{0j}(\text{Intercept}) \\ &\quad + \pi_{1j}(\text{Within-Subject Conception Risk}) \\ &\quad + \pi_{2j}(\text{Day}) + e_{ij}, \end{aligned} \tag{1}$$

$$\pi_{0j} = \beta_{00} + \beta_{01}(\text{Between-Subjects Conception Risk}) + \beta_{02}(\text{Masculinity}) + \beta_{03}(\text{NC}) + \beta_{04}(\text{Between-Subjects Conception Risk} \times \text{Masculinity}) + \beta_{05}(\text{Between-Subjects Conception Risk} \times \text{NC}) + \beta_{06}(\text{Masculinity} \times \text{NC}) + \beta_{07}(\text{Between-Subjects Conception Risk} \times \text{Masculinity} \times \text{NC}) + r_{0j}, \quad (2)$$

$$\pi_{1j} = \beta_{10} + \beta_{11}(\text{Masculinity}) + \beta_{12}(\text{NC}) + \beta_{13}(\text{Masculinity} \times \text{NC}), \quad (3)$$

$$\pi_{2j} = \beta_{20} + r_{2j}, \quad (4)$$

where (a) NC represents "normally cycling," (b) Day was centered around the sample mean, (c) the between-subjects conception risk and husbands' average behavioral masculinity scores were standardized, (d) the Level-2 Intercept and Day estimates were allowed to vary across wives, and (e) the crucial Within-Subject Conception Risk × Masculinity × NC interaction estimated at Level 2 (see β_{13} in Equation 3) tests the key prediction. Deviance tests confirmed that all random and fixed effects were the most appropriate.

Results

The results are reported in Table 1. As can be seen, consistent with predictions, the crucial Within-Subject Conception Risk × Masculinity × NC interaction emerged as significant. This three-way interaction is depicted in Figure 1. To decompose this interaction, I first examined the Within-Subject Conception Risk × Masculinity interaction separately for those wives who reported nonnormally cycling versus those who reported normally cycling. As expected, among nonnormally cycling wives, the Within-Subject Conception Risk × Masculinity interaction was not significant ($\beta = -.74$, $SE = 1.36$), $t(698) = -.55$, $p = .585$, and within-subject conception risk was not associated with daily marital satisfaction on average ($\beta = .91$, $SE = 1.64$), $t(698) = .56$, $p = .577$. This nonsignificant two-way interaction is depicted in Panel A of Figure 1. Among normally cycling wives, in contrast, the Within-Subject Conception Risk × Masculinity interaction was significant ($\beta = 4.99$, $SE = 1.98$), $t(698) = 2.52$, $p = .012$, effect size $r = .09$. This significant two-way interaction is depicted in Panel B of Figure 1. I further decomposed this two-way interaction by estimating the simple effects of normally cycling wives' within-subject conception risk for those with husbands relatively low

Table 1
Associations Between Wives' Daily Conception Risk, Husbands' Self-Reported Behavioral Masculinity, Wives' Cycle Normality, and Wives' Daily Marital Satisfaction

Variable	β	*SE*	*df*	Effect size *r*
Intercept	6.13***	.14	62	
Between-subjects conception risk (BPCR)	−.04	.14	62	.04
Husbands' behavioral masculinity (M)	−.03	.17	62	.02
Normal cycling (NC)	.09	.17	62	.07
BPCR × M	−.17	.14	62	.15
BPCR × NC	.09	.17	62	.06
M × NC	.03	.21	62	.02
BPCR × M × NC	.19	.18	62	.13
Day	.01	.01	69	.10
Within-subject conception risk (WPCR)	5.86†	3.13	698	.07
WPCR × M	4.99*	1.98	698	.09
WPCR × NC	−4.95	3.53	698	.05
WPCR × M × NC	−5.73*	2.39	698	.09

Note. Effect size $r = \sqrt{\frac{t^2}{t^2+df}}$.
† $p < .10$. * $p < .05$. *** $p < .001$.

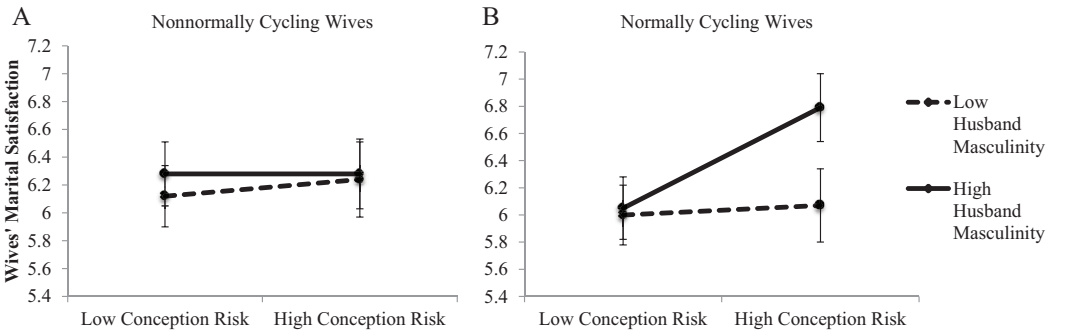

Figure 1. Interactive effect of wives' conception risk, husbands' average behavioral masculinity, and wives' cycle, on wives' daily marital satisfaction. Low conception risk = .000; high conception risk = .094. Error bars represent standard errors.

(1 *SD* below the sample mean) versus relatively high (1 *SD* above the sample mean) in behavioral masculinity. Inconsistent with predictions, conception risk was unassociated with marital satisfaction among normally cycling wives with husbands relatively low in self-reported behavioral masculinity ($\beta = .79$, $SE = 4.34$), $t(698) = .18$, $p = .855$. In contrast, and consistent with predictions, within-subject conception risk was positively associated with marital satisfaction among normally cycling wives with husbands relatively high in behavioral masculinity ($\beta = 10.75$, $SE = 2.96$), $t(698) = 3.63$, $p < .001$, effect size $r = .14$. Notably, three additional analyses demonstrated that the predicted three-way interaction (a) held controlling for husbands' daily marital satisfaction, where husbands' person-centered scores were entered at Level 1, husbands' grand-mean-centered scores were entered on the Level-2 intercept, and the Level-2 parameter was allowed to vary across individuals, to allow for examination of the association between wives' daily marital satisfaction and within-subject and between-subjects differences in husbands' marital satisfaction ($\beta = -5.47$, $SE = 2.29$), $t(574) = -2.39$, $p = .017$, effect size $r = .10$[1]; (b) held controlling for wives' age, grand-mean-centered and entered on the Level-2 intercept ($\beta = -5.73$, $SE = 2.40$), $t(698) = -2.38$, $p = .017$, effect size $r = .09$; and (c) emerged as marginally significant using the forward-cycle-day estimate of conception risk ($\beta = -7.89$, $SE = 4.15$), $t(688) = -1.90$, $p = .058$, effect size $r = .07$, where the key simple Conception Risk × Masculinity effect among normally cycling wives continued to emerge as significant ($\beta = 8.03$, $SE = 3.76$), $t(688) = 2.13$, $p = .033$, effect size $r = .08$.

Discussion

Although masculine men confer numerous reproductive benefits (Gangestad et al., 2007; Thornhill & Gangestad, 1999), they tend to be less likely to adopt long-term mating strategies and thus pose important reproductive risks as well (Booth & Dabbs, 1993; Boothroyd et al., 2007; Gangestad & Simpson, 2000; Gray et al., 2007; Kruger, 2006; Perrett et al., 1998; Roney et al., 2006; van Anders & Goldey, 2010; van Anders et al., 2007). Accordingly, scholars have proposed that women evolved to prefer masculine traits near peak fertility—a time when they can gain genetic benefits for their offspring (Buss & Shackelford, 2008; Gangestad & Simpson, 2000). Although ancestral women mated with relatively less masculine long-term-oriented partners may have been more likely to experience declines in relationship satisfaction near peak fertility and thus seek masculine extra-pair mates (see Gangestad et al., 2005; Gangestad et al., 2010b; Haselton & Gangestad,

[1] According to that analysis, husbands' within-subject variability in daily marital satisfaction ($\beta = .40$, $SE = .07$), $t(68) = 5.89$, $p < .001$, effect size $r = .58$, and husbands' between-subjects variability in daily marital satisfaction ($\beta = .34$, $SE = .12$), $t(60) = 2.88$, $p = .006$, effect size $r = .35$, were positively associated with wives' daily fluctuations in marital satisfaction.

2006; Larson et al., 2012), ancestral women mated with relatively more masculine long-term-oriented partners may have experienced increases in relationship satisfaction near peak fertility.

The current study provided evidence to support this latter possibility by revealing an association between wives' daily marital satisfaction, wives' daily changes in conception risk, their husbands' behavioral masculinity, and whether those wives were normally cycling. Among nonnormally cycling wives, wives' daily changes in conception risk were unassociated with changes in their daily marital satisfaction, regardless of their husbands' level of self-reported behavioral masculinity. Normally cycling wives, in contrast, became more satisfied as they neared peak fertility when they were married to relatively more behaviorally masculine husbands but demonstrated no such shifts in satisfaction when they were married to relatively less behaviorally masculine husbands. Notably, this effect (a) emerged using two different methods of assessing conception risk (i.e., the reverse-cycle-day and forward-cycle-day methods), (b) held controlling for between-subjects differences and within-subject differences in husbands' marital satisfaction, and (c) held controlling for wives' age.

The fact that normally cycling wives with relatively less masculine partners reported steady levels of marital satisfaction across their menstrual cycles may seem surprising. Indeed, the same theoretical rationale that I used to predict the positive association between within-subject conception risk and marital satisfaction among wives with more-masculine husbands suggests wives with less-masculine husbands should become less satisfied near peak fertility. It is unclear whether this null effect would generalize to other relationships, however. Given that these wives were recently married (within four months), it is possible that although they were more accepting of their relatively less-masculine husbands, they may begin to experience declines in marital satisfaction at peak fertility over time. Examining the extent to which this null effect continues to emerge in a sample of couples that have been married for an extended period of time may be a fruitful avenue for future research.

Strengths and Limitations

Several strengths of the current research may enhance confidence in the results reported here. First, the primary effect replicated using an alternative estimation of wives' conception risk (i.e., estimated using the forward-cycle-day method), suggesting that the effect is not confined to a single estimate of conception risk. Second, the current study utilized a relatively diverse sample, suggesting that the findings may generalize to a relatively broad range of people. Third, given that factors such as hormonal contraceptive use and pregnancy suppress ovulation, the current study provided stronger evidence that the association was due to hormonal fluctuations associated with ovulation by demonstrating that the primary effect emerged only among normally cycling women. Thus, it provided additional support for the theoretical framework that guided the main prediction. Fourth, the current study utilized husbands' reports of their own behavioral masculinity rather than wives' perceptions of husbands' behavioral masculinity, helping to reduce the possibility that some quality common to women who perceive different levels of partner behavioral masculinity accounted for these results. Finally, the current study used participants who responded on the basis of their actual intimate relationships, rather than hypothetical, laboratory-based, or prior relationships. Thus, the outcome measure, wives' relationship satisfaction, was both real and consequential.

Nevertheless, several factors limit interpretations of the current findings until they can be replicated and extended. First, and most notably, although the homogeneity of this newlywed sample reduced error variance and thus may have facilitated my ability to detect the predicted effect, generalizations to other samples (e.g., long-term-oriented dating couples, older married couples) should be made with caution until this effect can be replicated and extended. For example, normally cycling women engaged in dating relationships may experience the daily relationship satisfaction fluctuations demonstrated here only to the extent that they and their partners are oriented toward the long term and toward future reproduction. Second, in the current study, husbands' own reports of their behavioral masculinity interacted with normally cycling wives' conception risk to predict wives'

daily marital satisfaction. It is possible, however, that wives' perceptions of their husbands' masculinity, which are likely not perfectly correlated with husbands' own reports of their masculinity, play a unique role in this association. Future research may benefit from examining this possibility. Third, although a 14-day diary study allows for a preliminary examination of the association between normally cycling women's daily changes in conception risk, their partners' self-reported behavioral masculinity, and those women's daily changes in relationship satisfaction, it is unclear whether this pattern continues to emerge across all stages of women's reproductive development. Future research may benefit from examining these associations across a longer period of time. Finally, although estimations of conception risk have been successfully used in prior research (e.g., Haselton & Gangestad, 2006; Miller & Maner, 2010), some wives in the current study may have nevertheless inaccurately reported the start of their previous menstruation and/or their average menstrual cycle length. Likewise, given that the current study utilized husbands' self-reported behavioral masculinity rather than objective ratings of husbands' behavioral masculinity, some husbands in the current study may have inaccurately perceived or reported their masculine behavioral displays. Accordingly, a construct other than behavioral masculinity that is correlated with such a tendency may account for these effects. Future research may benefit from attempting to replicate the effect demonstrated here using objective measures of women's ovulatory status and their partners' behavioral masculinity.

Implications and Future Directions

This finding has both theoretical and practical implications. First, it joins a growing literature (e.g., Gangestad et al., 2005; Larson et al., 2012, 2013; Meltzer, McNulty, Jackson, & Karney, 2014b; Meltzer, McNulty, & Maner, 2015; Russell, McNulty, Baker, & Meltzer, 2014) demonstrating that evolutionary perspectives on human mating can provide novel insights into long-term-oriented relationships, such as marriage. Although ancestral women may have evolved to prefer masculine traits for the purpose of short-term mating (Buss & Shackelford, 2008; Gangestad & Simpson, 2000), the current findings demonstrate that even women's long-term-oriented relationships may benefit to the extent that their partners are relatively masculine. That is, women with long-term mates who report relatively high behavioral masculinity are more satisfied with their relationships at peak fertility compared to less-fertile phases of their menstrual cycles. Given that ancestral women likely incurred genetic benefits from relatively more masculine partners, an increase in relationship satisfaction at peak fertility may also be associated with increased sexual desire for those partners that likely functioned to produce higher quality offspring. Of course, it is possible that such women also incur important costs associated with their partners' masculinity, such as decreased loyalty or investment, which were not examined here. Accordingly, as such women transition to parenthood, they may experience declines in relationship satisfaction due to their masculine partners' decreased investment in offspring. Future research may benefit from examining this potential cost.

Relatedly, it is likely that the current effects are further moderated by women's own mate value, such that women with higher mate value may be more likely to capitalize on these benefits associated with their partners' masculinity whereas women with lower mate value may be more likely to suffer the costs of long-term masculine partners. Indeed, research (Buss & Shackelford, 2008) has suggested that women's own mate values predict their standards for long-term mates, such that women with relatively lower mate values are more likely to pursue a mixed-mating strategy whereas women with relatively high mate values are more likely to adopt long-term mating strategies and pursue long-term mates with indicators of both good genes and good investment. Future research may also benefit from examining this possibility.

Second, these findings join other research (see Gangestad et al., 2004) in demonstrating that women's shifting preference for partner masculinity extends beyond men's physical characteristics to men's self-reported behavioral masculinity such as assertiveness, dominance, and powerfulness. Whereas Larson et al. (2013) demonstrated that women near peak fertility report increased satisfaction with partners they perceive as sexually attractive, which may be reflective of physical characteristics associated

with masculinity, the current study demonstrated similar effects on the basis of men's own ratings of their behavioral masculinity. Whereas physical masculinity may indicate good genes associated with health, self-reported behavioral masculinity may indicate good genes associated with intrasexual competition and resource acquisition (Gangestad et al., 2004).

Finally, although the current study demonstrated that between-subjects differences in women's hormonal contraceptive use further moderated the interactive effect of women's fertility and their partners' self-reported behavioral masculinity for women's relationship outcomes, it is possible that within-subject changes in women's hormonal contraceptive use may play an important role. Many women either (a) meet their long-term partners while not using hormonal contraceptives and then begin using hormonal contraceptives during the course of their relationships or (b) meet their long-term partners while using hormonal contraceptives and discontinue using hormonal contraceptives during the course of their relationships to conceive. Given that recent research has demonstrated that such within-subject changes interact with partner qualities to predict women's long-term relationship satisfaction (Russell et al., 2014), women may experience shifts in relationship satisfaction that correspond to their (a) conception risk, (b) partners' behavioral masculinity, and (c) changes in hormonal contraceptive use throughout the course of their marriage. Future research may benefit from exploring this possibility.

References

Apicella, C. L., Feinberg, D. R., & Marlowe, F. W. (2007). Voice pitch predicts reproductive success in male hunter–gatherers. *Biology Letters, 3,* 682–684. http://dx.doi.org/10.1098/rsbl.2007.0410

Atkins, D. C., Baucom, D. H., & Jacobson, N. S. (2001). Understanding infidelity: Correlates in a national random sample. *Journal of Family Psychology, 15,* 735–749. http://dx.doi.org/10.1037/0893-3200.15.4.735

Booth, A., & Dabbs, J. M. (1993). Testosterone and men's marriages. *Social Forces, 72,* 463–477. http://dx.doi.org/10.1093/sf/72.2.463

Booth, A., Johnson, D. R., & Granger, D. A. (1999). Testosterone and men's health. *Journal of Behavioral Medicine, 22,* 1–19. http://dx.doi.org/10.1023/A:1018705001117

Boothroyd, L. G., Jones, B. C., Burt, D. M., & Perrett, D. I. (2007). Partner characteristics associated with masculinity, health and maturity in male faces. *Personality and Individual Differences, 43,* 1161–1173. http://dx.doi.org/10.1016/j.paid.2007.03.008

Box, G. E., & Tiao, G. C. (1973). *Bayesian inference in statistical analysis*. Reading, MA: Addison-Wesley.

Bryk, A. S., & Raudenbush, S. W. (1992). *Hierarchical linear models: Applications and data analysis methods*. Newbury Park, CA: Sage.

Bryk, A. S., Raudenbush, S. W., & Congdon, R. T. (1994). *HLM: Hierarchical linear modeling with the HLM/2L and HLM/3L programs*. Chicago, IL: Scientific Software International.

Buss, D. M., & Shackelford, T. K. (2008). Attractive women want it all: Good genes, economic investment, parenting proclivities, and emotional commitment. *Evolutionary Psychology, 6,* 134–146. http://dx.doi.org/10.1177/147470490800600116

DeBruine, L. M., Jones, B. C., Little, A. C., Boothroyd, L. G., Perrett, D. I., Penton-Voak, I. S., . . . Tiddeman, B. P. (2006). Correlated preferences for facial masculinity and ideal or actual partner's masculinity. *Proceedings of the Royal Society B: Biological Sciences, 273,* 1355–1360. http://dx.doi.org/10.1098/rspb.2005.3445

Eastwick, P. W., & Finkel, E. J. (2012). The evolutionary armistice attachment bonds moderate the function of ovulatory cycle adaptations. *Personality and Social Psychology Bulletin, 38,* 174–184. http://dx.doi.org/10.1177/0146167211422366

Fehring, R. J., Schneider, M., & Raviele, K. (2006). Variability in the phases of the menstrual cycle. *Journal of Obstetric, Gynecologic, and Neonatal Nursing, 35,* 376–384. http://dx.doi.org/10.1111/j.1552-6909.2006.00051.x

Feinberg, D. R., Jones, B. C., Law Smith, M. J., Moore, F. R., DeBruine, L. M., Cornwell, R. E., . . . Perrett, D. I. (2006). Menstrual cycle, trait estrogen level, and masculinity preferences in the human voice. *Hormones and Behavior, 49,* 215–222. http://dx.doi.org/10.1016/j.yhbeh.2005.07.004

Folstad, I., & Karter, A. J. (1992). Parasites, bright males, and the immunocompetence handicap. *American Naturalist, 139,* 603–622. http://dx.doi.org/10.1086/285346

Gangestad, S. W., Garver-Apgar, C. E., Simpson, J. A., & Cousins, A. J. (2007). Changes in women's mate preferences across the ovulatory cycle. *Journal of Personality and Social Psychology, 92,* 151–163. http://dx.doi.org/10.1037/0022-3514.92.1.151

Gangestad, S. W., & Simpson, J. A. (2000). The evolution of human mating: Trade-offs and strategic pluralism. *Behavioral and Brain Sciences, 23,*

573–587. http://dx.doi.org/10.1017/S0140525X0000337X

Gangestad, S. W., Simpson, J. A., Cousins, A. J., Garver-Apgar, C. E., & Christensen, P. N. (2004). Women's preferences for male behavioral displays change across the menstrual cycle. *Psychological Science, 15,* 203–207. http://dx.doi.org/10.1111/j.0956-7976.2004.01503010.x

Gangestad, S. W., Thornhill, R., & Garver-Apgar, C. E. (2005). Women's sexual interests across the ovulatory cycle depend on primary partner developmental instability. *Proceedings of the Royal Society B: Biological Sciences, 272,* 2023–2027. http://dx.doi.org/10.1098/rspb.2005.3112

Gangestad, S. W., Thornhill, R., & Garver-Apgar, C. E. (2010a). Fertility in the cycle predicts women's interest in sexual opportunism. *Evolution and Human Behavior, 31,* 400–411. http://dx.doi.org/10.1016/j.evolhumbehav.2010.05.003

Gangestad, S. W., Thornhill, R., & Garver-Apgar, C. E. (2010b). Men's facial masculinity predicts changes in their female partners' sexual interests across the ovulatory cycle, whereas men's intelligence does not. *Evolution and Human Behavior, 31,* 412–424. http://dx.doi.org/10.1016/j.evolhumbehav.2010.06.001

Garver-Apgar, C. E., Gangestad, S. W., & Thornhill, R. (2008). Hormonal correlates of women's midcycle preference for the scent of symmetry. *Evolution and Human Behavior, 29,* 223–232. http://dx.doi.org/10.1016/j.evolhumbehav.2007.12.007

Getty, T. (2002). Signaling health versus parasites. *American Naturalist, 159,* 363–371. http://dx.doi.org/10.1086/338992

Gray, P. B., Parkin, J. C., & Samms-Vaughan, M. E. (2007). Hormonal correlates of human paternal interactions: A hospital-based investigation in urban Jamaica. *Hormones and Behavior, 52,* 499–507. http://dx.doi.org/10.1016/j.yhbeh.2007.07.005

Harris, C. R., Chabot, A., & Mickes, L. (2013). Shifts in methodology and theory in menstrual cycle research on attraction. *Sex Roles, 69,* 525–535. http://dx.doi.org/10.1007/s11199-013-0302-3

Haselton, M. G., & Gangestad, S. W. (2006). Conditional expression of women's desires and men's mate guarding across the ovulatory cycle. *Hormones and Behavior, 49,* 509–518. http://dx.doi.org/10.1016/j.yhbeh.2005.10.006

Karney, B. R., & Bradbury, T. N. (1995). The longitudinal course of marital quality and stability: A review of theory, methods, and research. *Psychological Bulletin, 118,* 3–34. http://dx.doi.org/10.1037/0033-2909.118.1.3

Karney, B. R., Kreitz, M. A., & Sweeney, K. E. (2004). Obstacles to ethnic diversity in marital research: On the failure of good intentions. *Journal of Social and Personal Relationships, 21,* 509–526. http://dx.doi.org/10.1177/0265407504044845

Kelley, H. H., & Thibaut, J. W. (1978). *Interpersonal relations: A theory of interdependence*. New York, NY: Wiley.

Kruger, D. J. (2006). Male facial masculinity influences attributions of personality and reproductive strategy. *Personal Relationships, 13,* 451–463. http://dx.doi.org/10.1111/j.1475-6811.2006.00129.x

Larson, C. M., Haselton, M. G., Gildersleeve, K. A., & Pillsworth, E. G. (2013). Changes in women's feelings about their romantic relationships across the ovulatory cycle. *Hormones and Behavior, 63,* 128–135. http://dx.doi.org/10.1016/j.yhbeh.2012.10.005

Larson, C. M., Pillsworth, E. G., & Haselton, M. G. (2012). Ovulatory shifts in women's attractions to primary partners and other men: Further evidence of the importance of primary partner sexual attractiveness. *PLoS ONE, 7,* e44456. http://dx.doi.org/10.1371/journal.pone.0044456

Li, N. P., & Meltzer, A. L. (2015). The validity of sex-differentiated mate preferences: Reconciling the seemingly conflicting evidence. *Evolutionary Behavioral Sciences, 9,* 89–106. http://dx.doi.org/10.1037/ebs0000036

Little, A. C., Jones, B. C., & Burriss, R. P. (2007). Preferences for masculinity in male bodies change across the menstrual cycle. *Hormones and Behavior, 51,* 633–639. http://dx.doi.org/10.1016/j.yhbeh.2007.03.006

McNulty, J. K., & Karney, B. R. (2001). Attributions in marriage: Integrating specific and global evaluations of a relationship. *Personality and Social Psychology Bulletin, 27,* 943–955. http://dx.doi.org/10.1177/0146167201278003

McNulty, J. K., & Widman, L. (2014). Sexual narcissism and infidelity in early marriage. *Archives of Sexual Behavior, 43,* 1315–1325. http://dx.doi.org/10.1007/s10508-014-0282-6

Meltzer, A. L., McNulty, J. K., Jackson, G. L., & Karney, B. R. (2014a). Men still value physical attractiveness in a long-term mate more than women: Rejoinder to Eastwick, Neff, Finkel, Luchies, and Hunt (2014). *Journal of Personality and Social Psychology, 106,* 435–440. http://dx.doi.org/10.1037/a0035342

Meltzer, A. L., McNulty, J. K., Jackson, G. L., & Karney, B. R. (2014b). Sex differences in the implications of partner physical attractiveness for the trajectory of marital satisfaction. *Journal of Personality and Social Psychology, 106,* 418–428. http://dx.doi.org/10.1037/a0034424

Meltzer, A. L., McNulty, J. K., & Maner, J. K. (2015). Women like being valued for sex and engaging in frequent sexual activity, as long as their partner is committed to a long-term relationship. *Archives of Sexual Behavior*. Advance online publication. http://dx.doi.org/10.1007/s10508-015-0622-1

Miller, S. L., & Maner, J. K. (2010). Scent of a woman: Men's testosterone responses to olfactory ovulation cues. *Psychological Science, 21,* 276–283. http://dx.doi.org/10.1177/0956797609357733

Møller, A. P., Christe, P., & Lux, E. (1999). Parasitism, host immune function, and sexual selection. *Quarterly Review of Biology, 74,* 3–20. http://dx.doi.org/10.1086/392949

Perrett, D. I., Lee, K. J., Penton-Voak, I., Rowland, D., Yoshikawa, S., Burt, D. M., . . . Akamatsu, S. (1998, August 27). Effects of sexual dimorphism on facial attractiveness. *Nature, 394,* 884–887. http://dx.doi.org/10.1038/29772

Pillsworth, E. G., & Haselton, M. G. (2006). Male sexual attractiveness predicts differential ovulatory shifts in female extra-pair attraction and male mate retention. *Evolution and Human Behavior, 27,* 247–258. http://dx.doi.org/10.1016/j.evolhumbehav.2005.10.002

Puts, D. A. (2005). Mating context and menstrual phase affect women's preferences for male voice pitch. *Evolution and Human Behavior, 26,* 388–397. http://dx.doi.org/10.1016/j.evolhumbehav.2005.03.001

Rhodes, G., Chan, J., Zebrowitz, L. A., & Simmons, L. W. (2003). Does sexual dimorphism in human faces signal health? *Proceedings of the Royal Society B: Biological Sciences, 270*(Suppl. 1), S93–S95. http://dx.doi.org/10.1098/rsbl.2003.0023

Rhodes, G., Simmons, L. W., & Peters, M. (2005). Attractiveness and sexual behavior: Does attractiveness enhance mating success? *Evolution and Human Behavior, 26,* 186–201. http://dx.doi.org/10.1016/j.evolhumbehav.2004.08.014

Roney, J. R., Hanson, K. N., Durante, K. M., & Maestripieri, D. (2006). Reading men's faces: Women's mate attractiveness judgments track men's testosterone and interest in infants. *Proceedings of the Royal Society B: Biological Sciences, 273,* 2169–2175. http://dx.doi.org/10.1098/rspb.2006.3569

Rusbult, C. E. (1980). Commitment and satisfaction in romantic associations: A test of the investment model. *Journal of Experimental Social Psychology, 16,* 172–186. http://dx.doi.org/10.1016/0022-1031(80)90007-4

Russell, V. M., McNulty, J. K., Baker, L. R., & Meltzer, A. L. (2014). The association between discontinuing hormonal contraceptives and wives' marital satisfaction depends on husbands' facial attractiveness. *PNAS Proceedings of the National Academy of Sciences of the United States of America, 111,* 17081–17086. http://dx.doi.org/10.1073/pnas.1414784111

Schumm, W. R., Nichols, C. W., Schectman, K. L., & Grigsby, C. C. (1983). Characteristics of responses to the Kansas Marital Satisfaction Scale by a sample of 84 married mothers. *Psychological Reports, 53,* 567–572. http://dx.doi.org/10.2466/pr0.1983.53.2.567

Shackelford, T. K., & Buss, D. M. (1997). Marital satisfaction in evolutionary psychology perspective. In R. J. Sternberg & M. Hojjat (Eds.), *Satisfaction in close relationships* (pp. 7–25). New York, NY: Guilford Press.

Stanley, S. M., & Markman, H. J. (1992). Assessing commitment in personal relationships. *Journal of Marriage and the Family, 54,* 595–608. http://dx.doi.org/10.2307/353245

Thornhill, R., & Gangestad, S. W. (1999). The scent of symmetry: A human pheromone that signals fitness? *Evolution and Human Behavior, 20,* 175–201. http://dx.doi.org/10.1016/S1090-5138(99)00005-7

Thornhill, R., & Gangestad, S. W. (2006). Facial sexual dimorphism, developmental stability, and susceptibility to disease in men and women. *Evolution and Human Behavior, 27,* 131–144. http://dx.doi.org/10.1016/j.evolhumbehav.2005.06.001

Trivers, R. (1972). Parental investment and sexual selection. In B. Campbell (Ed.), *Sexual selection and the descent of man* (pp. 136–179). Chicago, IL: Aldine-Antherton.

van Anders, S. M., & Goldey, K. L. (2010). Testosterone and partnering are linked via relationship status for women and "relationship orientation" for men. *Hormones and Behavior, 58,* 820–826. http://dx.doi.org/10.1016/j.yhbeh.2010.08.005

van Anders, S. M., Hamilton, L. D., & Watson, N. V. (2007). Multiple partners are associated with higher testosterone in North American men and women. *Hormones and Behavior, 51,* 454–459. http://dx.doi.org/10.1016/j.yhbeh.2007.01.002

Wilcox, A. J., Dunson, D. B., Weinberg, C. R., Trussell, J., & Baird, D. D. (2001). Likelihood of conception with a single act of intercourse: Providing benchmark rates for assessment of postcoital contraceptives. *Contraception, 63,* 211–215. http://dx.doi.org/10.1016/S0010-7824(01)00191-3

Received October 21, 2015
Revision received August 23, 2016
Accepted August 29, 2016 ■