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Each month, millions of women experience an ovulatory cycle that regulates fertility. Previous consumer research has found that this cycle influences women's clothing and food preferences. The authors propose that the ovulatory cycle actually has a much broader effect on women's economic behavior. Drawing on theory in evolutionary psychology, the authors hypothesize that the week-long period near ovulation should boost women's desire for relative status, which should alter their economic decisions. Findings from three studies show that women near ovulation seek positional goods to improve their social standing. Additional findings reveal that ovulation leads women to pursue positional goods when doing so improves relative standing compared with other women but not compared with men. When playing the dictator game, for example, ovulating women gave smaller offers to a female partner but not to a male partner. Overall, women's monthly hormonal fluctuations seem to have a substantial effect on consumer behavior by systematically altering their positional concerns, a finding that has important implications for marketers, consumers, and researchers.

Keywords: evolutionary psychology, hormones, status, positional goods, behavioral economics

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Money, Status, and the Ovulatory Cycle

Imagine that you are a woman about to graduate from college. You're offered two jobs: Option A, for which you would make $50,000 a year, and Option B, for which you would make $100,000. Which would you choose? If the jobs are otherwise identical, this is a no-brainer—almost everyone would choose the second, better-paying option. But consider the following catch: If you choose the higher-paying Option B, your peers would get jobs making double your salary ($200,000). If you choose the lower-paying Option A, your peers would earn half as much as you ($25,000). Although Option B provides a higher income, it is not as much as what your peers would make; in contrast, although Option A provides a lower income, it is more money than what your peers would receive.

When women are asked this question, approximately half (56%) choose Option A, taking less money for themselves to gain more relative status compared with their peers (Solnick and Hemenway 1998). The same patterns emerge not only for income-related questions but also in other domains, such as how much intelligence people want to have or how large they want their house to be. These examples highlight that humans care about hierarchy and their relative position compared with others (Frank 1985, 1991; Veblen 1899). When people make a purchase, for example, getting the best product is not always as important as getting something better than what one's peers have (Drèze and Nunes 2009; Ordabayeva and Chandon 2011).

Yet although people clearly care about their relative status, they do not always choose relative standing over absolute gains. Indeed, in the aforementioned studies, roughly half the time, women chose to forgo an increase in their relative standing to maximize their own individual benefits (Frank 1991; Solnick and Hemenway 1998). Considering that women might sometimes be more motivated by positional

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concerns, what factors might influence whether they will be more versus less concerned about their relative status?

In this article, we examine how women's desire for status may be linked to a surprising biological factor: hormonal variation associated with the monthly ovulatory cycle. Drawing on theory in evolutionary psychology and animal behavior, we propose that women's positional concerns should be elevated in the week-long period of the cycle when they are fertile—the ovulatory phase. In turn, we predict that women in the ovulatory phase should be especially motivated to seek positional goods that improve their standing relative to other women.

This research contributes to the literature by revealing that women's monthly hormonal fluctuations have a systematic and substantial effect on consumer behavior. Whereas prior consumer research has found that the ovulatory cycle alters women's clothing and food preferences (Durante et al. 2011; Saad and Stenstrom 2012), we show that the cycle has a much broader effect on economic behavior by altering women's positional concerns. The effect of the ovulatory cycle on positional concerns has important implications for marketers, researchers, and consumers. Female consumers, for example, may be most tempted to buy status products during particular times of the month. Researchers might find different effects in studies depending on the mix of women in the study and where they are in their cycle. Marketers may provoke different female responses from the same message at different times of the month. Broadly, documenting a shift in women's desire for relative status at peak fertility has implications for understanding how mating goals in general affect women's economic decisions.

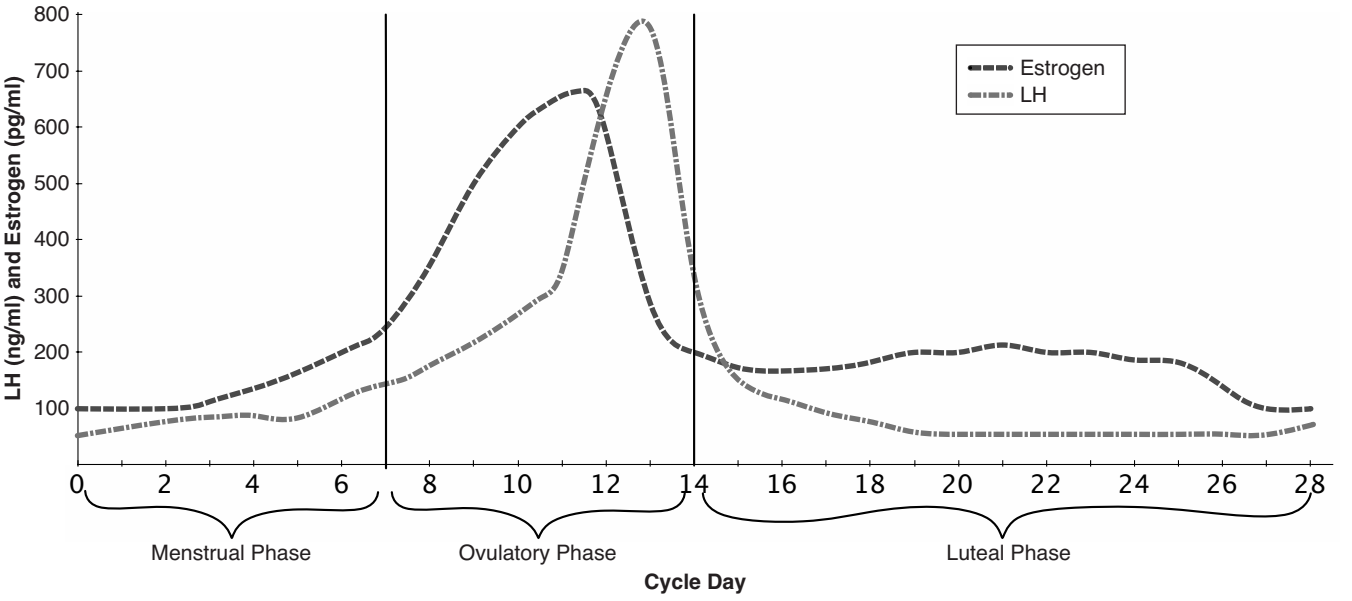
THE OVULATORY CYCLE

The human ovulatory cycle spans on average 28 days. A woman is fertile and can become pregnant on only approximately seven days of each cycle, the ovulatory phase. Although women typically do not know when they are ovulating without specific training or equipment (Haselton and Gildersleeve 2011), research has shown that ovulation can influence women's psychology nonconsciously (for a review, see Thornhill and Gangestad 2008).

Because ovulation, or estrus, in other animals is known to influence mating behavior, the majority of research in humans has examined how ovulation affects women's mate preferences. Such work has found that ovulation leads women to be more interested in mating. For example, ovulating women have greater interest in meeting men (Haselton and Gangestad 2006), pay more attention to men (Anderson et al. 2010), and are more likely to cheat on their current romantic partner (Garver-Apgar et al. 2006). Consistent with these changes in women's mating psychology, ovulation also leads women to enhance their appearance (Durante, Li, and Haselton 2008; Grammer, Renninger, and Fischer 2004; Haselton et al. 2007). Women in the ovulatory phase of their cycle seek sexier clothing (Durante et al. 2011), spend more money on appearance-enhancing products (Pine and Fletcher 2011; Saad and Stenstrom 2012), and earn more in tips from men (Miller, Tybur, and Jordan 2007). It is important to note that because the women in these studies are typically not aware of whether they are in the fertile phase of their cycle, the effects of ovulation on psychology and behavior are rarely conscious or deliberate.

These kinds of ovulatory effects are driven by estrogen and the luteinizing hormone, which fluctuate in specific ways across the cycle (Lipson and Ellison 1996). Levels of these sex hormones peak in the week of the ovulatory phase each month when women are most fertile (Jones 1997; see Figure 1). If pregnancy does not occur, hormone levels drop back to the baseline a few days after ovulation (Venners et

Figure 1
HORMONAL LEVELS DURING THE PHASES OF THE FEMALE MONTHLY MENSTRUAL CYCLE



Notes: This figure is based on Jones (1997). LH = luteinizing hormone. Note that levels of estrogen and luteinizing hormone peak in the ovulatory phase of the cycle.

al. 2006). Consistent with these hormonal drivers, the behavioral effects of the ovulatory phase are suppressed when women use hormonal contraception (e.g., the Pill, the Patch, vaginal rings, hormonal intrauterine devices; Fleischman, Navarette, and Fessler 2010; Miller, Tybur, and Jordan 2007). Because contraception disrupts the normal fluctuation of female sex hormones across the cycle, it erases any behavioral effects associated with normal ovulation.

THE OVULATORY COMPETITION HYPOTHESIS

Reproduction is the engine of natural selection. Because throughout evolutionary history female mammals have been able to reproduce for only a brief window each month, women's behavioral tendencies are believed to shift during this ovulatory window in ways that enhance their reproductive fitness (Thornhill and Gangestad 2008). Given the importance of mating in achieving reproductive fitness, prior research has focused on uncovering ways in which ovulation produces specific shifts in women's mating psychology. The overarching finding in this literature stream is that ovulating women have increased sexual desire for the types of men believed to possess markers of genetic fitness, such as men who are more symmetrical, muscular, and socially dominant (Durante et al. 2012; Gangestad et al. 2004; Gangestad, Thornhill, and Garver-Apgar 2010; Johnston et al. 2001; Penton-Voak et al. 1999).

Although mating is an important part of enhancing reproductive fitness for any social animal, reproductive fitness involves much more than mating and sex. In addition to successfully attracting a mate, enhancing reproductive fitness also involves the fundamental challenge of successfully outcompeting same-sex individuals for status and access to mates (Griskevicius and Kenrick 2013; Kenrick et al. 2010; Saad 2007, 2008, 2011).

Across mammals, the ovulatory phase leads the female sex to maximize reproductive opportunities, with research in nonhuman primates showing that ovulation has a direct effect on female competitive behaviors. For example, female rhesus monkeys become more aggressive and competitive during the ovulatory phase (Walker, Wilson, and Gordon 1983; Wallen 2000). This finding suggests that ovulation in women might not only alter their mate preferences but also influence their competitive tendencies.

We refer to the idea that ovulation should amplify women's intrasexual competition as the "ovulatory competition hypothesis." Because successfully attracting a mate involves outcompeting other females for access to mates, we propose that women should become more competitive with other women at ovulation.

Although relatively little research has considered how the ovulatory cycle affects outcomes not directly related to mating, some evidence does suggest that women might become more competitive during ovulation. For example, women near ovulation are more likely to derogate other women (Fisher 2004; Piccoli, Foroni, and Carnaghi 2013). Ovulation is also known to have the largest effect on women's desire to dress in sexier outfits, specifically when there are many attractive rivals nearby—and, thus, when women most need to increase their own attractiveness to compete with others for male attention (Durante et al. 2011). Here, we consider whether ovulation might alter women's positional concerns in the consumer marketplace.

OVULATION AND POSITIONAL CONCERNS

According to the ovulatory competition hypothesis, women in the ovulatory phase should be particularly sensitive to their relative standing compared with other women. Just as ovulating female primates use threatening gestures to boost their position relative to rivals, ovulating women may experience increased desire for status over other women. This phenomenon suggests that ovulating women may be more motivated by positional concerns.

Positional concerns are often reflected in consumer choices. For example, people often seek products such as jewelry or cars for status reasons because they want to possess products that are relatively superior to those of others (Han, Nunes, and Drèze 2010). If ovulation leads women to be more motivated by relative status, they may be especially likely to seek products that provide them with a relative gain compared with other women.

Consider a choice between receiving a $7,000 or a $5,000 diamond ring. Although most women tend to prefer the more expensive ring, this preference is likely to be altered by information regarding the kind of rings possessed by other women. For example, if receiving a $7,000 ring means that other women would receive $15,000 rings, but receiving a $5,000 ring means that other women would receive $1,000 rings, women face a trade-off between maximizing their own individual absolute gains versus maximizing their relative gains compared with other women. According to our model, women in the ovulatory phase should be more concerned with relative status, meaning that they should be more motivated to possess products that are relatively better than those of other women, even if it means choosing the less valuable product. Formally:

H_1: Ovulation amplifies women's tendency to seek relative rather than absolute gains when the comparison group is other women.

Should ovulation always lead women to maximize relative benefits? The ovulatory competition hypothesis asserts that the fertile phase of the cycle should specifically amplify women's intrasexual competition, which refers to competition against same-sex individuals. Research in animal behavior, for example, has shown that ovulation leads female primates to become more aggressive and confrontational with other female primates but not with male primates (Mallow 1981; Walker, Wilson, and Gordon 1983; Wallen 2000). This finding suggests an important boundary condition for when ovulation should influence women's behavior: the fertile phase of the cycle should have a different effect on women's choices depending on whether those choices improve women's standing relative to other women (who are intrasexual rivals) versus men (who are potential mates). Therefore, we predict that the gender of the social comparison group should be a key moderating variable in whether ovulation increases women's tendency to seek relative gains. Specifically:

H_2: Ovulation amplifies women's tendency to seek relative gains when doing so improves relative standing compared with other women but not when compared with men.

Finally, the effect of the ovulatory cycle is likely to manifest itself not only in women's consumer choices but also in their financial decisions that have bearing on other people.

For example, ovulation is likely to alter choices in economic games that involve other players (Lucas and Koff 2013).

Consider the "dictator game," which is commonly used in behavioral economics (Camerer and Thaler 1995; Kahneman, Knetsch, and Thaler 1986). In this game, a player is given a fixed amount of money and is tasked with dividing it between herself and another person. The player—the "dictator"—can give as much or as little of the money to the other person as she dictates. The more the player gives, however, the less money she gets for herself.

We hypothesize that ovulation should alter the size of women's offers in the dictator game. In line with the ovulatory competition hypothesis, however, we predict that ovulation should have a different effect on women's offers depending on whether the other player is male or female. Given that ovulating women should be motivated to improve relative standing compared with other women, ovulation should lead them to make smaller offers to female players. However, ovulation should not have the same effect on offers to men, who do not constitute intrasexual rivals. Indeed, because ovulating women are known to have increased motivation to attract men (Anderson et al. 2010; Durante et al. 2012; Haselton and Gangestad 2006), ovulation may lead women to be more generous to men in the dictator game. Formally:

H_3: In the dictator game, ovulation should lead women to give smaller financial offers to other women but not to men.

RESEARCH OVERVIEW

Three studies examine how the ovulatory cycle influences women's positional concerns. In line with the ovulatory competition hypothesis, we predicted that women in the ovulatory phase should be more motivated by relative status, as reflected in their consumer choices and financial decisions. Study 1 examines how ovulation influences women's choices between maximizing absolute versus relative gains, testing whether ovulating women are more motivated to choose products that provide a relative benefit (H_1). Study 2 investigates an important boundary condition of this effect, testing whether ovulating women aim to materially outdo other women but not men (H_2). Finally, Study 3 considers how ovulation influences women's behavior in an incentive-compatible dictator game, testing whether ovulating women give less money to other women but not to men (H_3).

To ensure robustness, the studies test ovulatory cycle effects in both college samples and more diverse samples of women. In addition, the studies use multiple methods to ascertain ovulation, including the established reverse-cycle-day method (Studies 1 and 2) and the more stringent method of urine applicator tests (Study 3).

STUDY 1: MAXIMIZING RELATIVE VERSUS ABSOLUTE GAINS

The ovulatory competition hypothesis suggests that ovulation should boost women's desire for positional advantage. In Study 1, therefore, ovulating and nonovulating women made product choices that could maximize either absolute gains or relative gains. Consistent with H_1, we predicted that ovulation should amplify women's tendency to seek relative gains.

Method

Participants were 309 women (M_{Age} = 27.8 years, SD = 5.92 years, range = 18–39 years) who had regular monthly menstrual cycles (25–35 days), were not on hormonal contraception, and were not taking prescription medication. The women were from the United States (45 states) and participated for payment through an Internet hosting site (Amazon.com's Mechanical Turk). Thirty percent of the participants were nonwhite, and 52% were single. Participants reported their yearly income from eight categories ranging from <$15,000 to >$150,000. Median yearly income was $35,001–$50,000. Ethnicity, relationship status, and income had no effect on the dependent measures (all *p*s > .30).

Fertility. Because we collected data from women across the entire cycle, we used the established reverse-cycle-day method to predict day of ovulation for each participant (see Durante et al. 2011, 2012; Haselton and Gangestad 2006; Miller, Tybur, and Jordan 2007). First, women answered questions related to their ovulatory cycle (in line with Durante et al. 2011, 2012; see Appendix A). From these answers, we then used the following information to estimate their fertility: (1) the start date of their last menstrual period, (2) the expected start date of the next period, and (3) the typical length of their cycle. Because our predictions involved how choices in the ovulatory phase would differ compared with choices made at other points in the cycle, we used established methods (e.g., Miller, Tybur, and Jordan 2007) to divide women across the entire cycle into the following two groups: (1) a high-fertility group (days 8–14, n = 80) and (2) a low-fertility group (days 1–7, n = 85; days 15–28, n = 144). The high-fertility group corresponds to the ovulatory phase of the cycle when women are most fertile (see Figure 1). The low-fertility group included women in the menstrual phase (days 1–7) and the luteal phase (days 15–28) of the cycle.

Product choices. Women made two product choices: one about a car and another about a ring. Each choice presented a trade-off between maximizing absolute gains versus relative gains (based on Frank 2005; for similar methods, see also Lens et al. 2013; Saad and Gill 2001b). Specifically, the choice for the car involved two options: (A) "You have a $25,000 car; other women have $40,000 cars," or (B) "You have a $20,000 car; other women have $12,000 cars." For the ring, the options were (A) "You have a $7,000 diamond ring; other women have $15,000 diamond rings," or (B) "You have a $5,000 diamond ring; other women have $1,000 diamond rings" (see Appendix B). The dependent measure was the percentage of women choosing the option that maximized their relative gains.

Results and Discussion

In the low-fertility group, the majority of women chose the option that maximized absolute gains for each product: 71.2% chose the more expensive ring, and 79.5% chose the more expensive car. The key research question was how the ovulatory phase would alter these choices compared with the low-fertility group.

Consistent with H_1, women in the high-fertility group were more likely to choose the relative gains option for each product (see Figure 2). For the ring, the high-fertility group selected the relative gain option more frequently than did

Figure 2
PERCENTAGE OF WOMEN SELECTING THE PRODUCT THAT PROVIDES A RELATIVE (VS. ABSOLUTE) GAIN AS A FUNCTION OF PHASE IN THE OVULATORY CYCLE (STUDY 1)

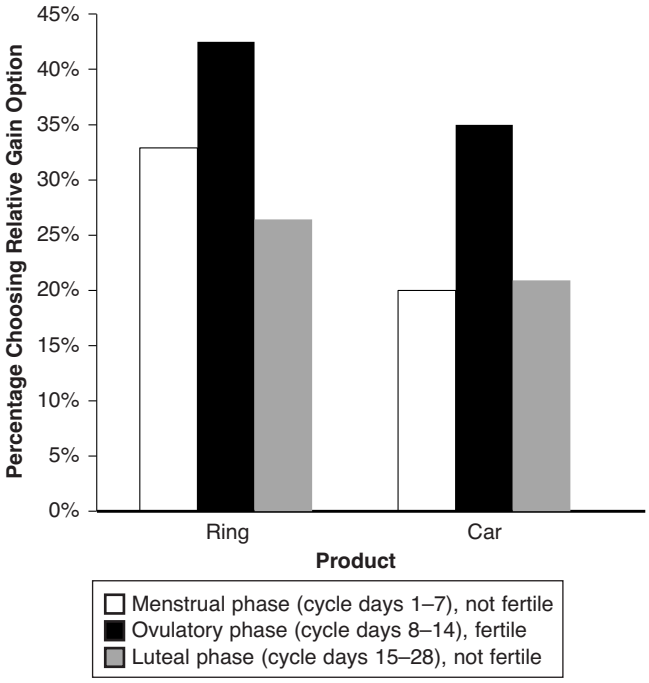
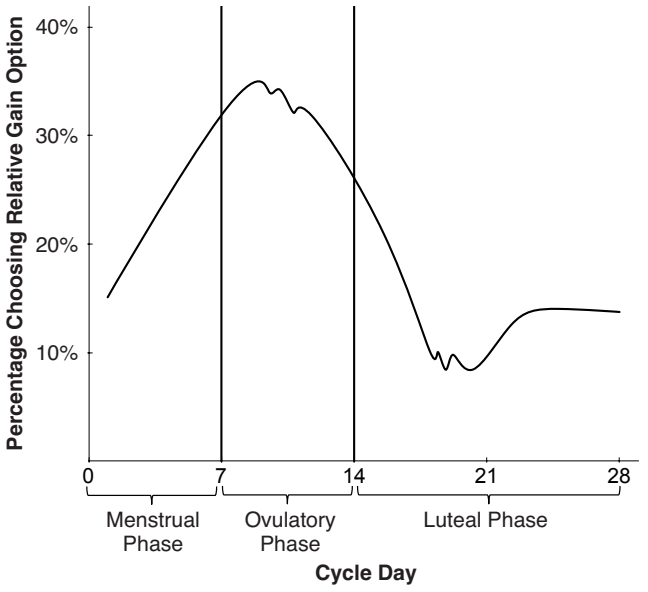


Figure 3
LOESS CURVE DEPICTING THE PERCENTAGE OF WOMEN SELECTING THE PRODUCT THAT PROVIDES A RELATIVE (VS. ABSOLUTE) GAIN ACROSS THE FULL OVULATORY CYCLE (STUDY 1)



Notes: The curve represents an average of the two products (car and ring).

the low-fertility group (42.5% vs. 28.8%, respectively; $\chi^2 = 4.93$, d.f. = 1, $p = .026$, d = .26). The high-fertility group also chose the relative gain option for the car more frequently than did the low-fertility group (35.0% vs. 20.5%, respectively; $\chi^2 = 6.43$, d.f. = 1, $p = .011$, d = .29).

We next studied the entire sample of women across the full cycle by examining product choices as a function of each woman's degree of fertility (see Saad and Stenstrom 2012). Given that the effect of ovulation on preference for the relative gain option should track the levels of estrogen and luteinizing hormone across the cycle (see Figure 1), women's choices across the cycle should show a specific curvilinear pattern resembling that in Figure 1. To test for this pattern, we conducted a hierarchically nested regression that included the linear term in the first step, followed by a model that included both a linear and a quadratic term. As we expected, preference for the relative gains option was positively related to fertility in a curvilinear manner (see Figure 3), as evidenced by a significant curvilinear relation between cycle day and probability of selecting the relative gains option ($\beta = -.48$, $t(306) = -2.01$, $p = .046$). As fertility in the cycle increased, so did the probability of selecting the choice that maximized a woman's relative standing. (For a complete summary of the statistical analyses, see the Web Appendix.) Overall, consistent with the ovulatory competition hypothesis, Study 1 indicates that women's level of desire for relative gains tracks the level of hormones associated with fertility across the cycle.

STUDY 2: STATUS RELATIVE TO OTHER WOMEN VERSUS MEN

In Study 2, we aim to test an important boundary condition of how the ovulatory cycle influences women's desire for positional goods. According to the ovulatory competition hypothesis, the fertile phase of the cycle should have different effects on a woman's choices depending on whether those choices improve a woman's standing relative to other women (i.e., intrasexual rivals) versus other men (i.e., potential mates). Study 1 indicates that ovulation boosts women's tendency to seek relative gains when given the opportunity to possess products superior to those of other women. However, we expect that ovulation should not have the same effect on women's choices if they have the opportunity to possess better products than men who are potential mates.

Study 2 involves a similar methodology as Study 1, testing how ovulating and nonovulating women made product choices between maximizing absolute gains versus relative gains. However, we explicitly varied whether the relative gains improved a woman's standing compared with either other women or men. Consistent with H_2, we predicted that ovulation should amplify women's tendency to seek relative gains when doing so improves relative standing compared with other women but not with men.

Method

Participants. Participants were 481 women (M_{Age} = 28.05 years, SD = 5.88, range = 18–47 years) who had regular monthly menstrual cycles (25–35 days), were not on hormonal contraception, and were not taking prescription

medication. Nonwhite participants composed 27.3% of the sample, and 48% of the sample were single. Median yearly income was $35,001–$50,000. Ethnicity, relationship status, and income had no effect on the dependent measures (all *p*s > .25).

The study had a 2 (fertility: high vs. low; between-subjects) × 2 (target comparison gender: men vs. women; within-subject) mixed design. The women were from the United States (49 states) and participated for payment through an Internet hosting site (Amazon.com's Mechanical Turk). They answered questions about their cycle at the beginning of the study, identical to the method used in Study 1. From this information, we divided participants into two groups: (1) a high-fertility group (days 8–14, n = 122) and (2) a low-fertility group (days 1–7, n = 164; days 15–28, n = 195).

Procedure. As in Study 1, women were asked to make two product choices. Because diamond rings would not be appropriate in the current study (women rarely compare their diamond rings with those of men), one choice in the current study involved a house and another involved a dinner at a restaurant. Again, each choice included two options that presented a trade-off between maximizing absolute gains versus relative gains.

Participants were randomly assigned to one of two counterbalanced conditions: their choices involved a comparison with other women (intrasexual rivals) or a comparison with men (potential mates). Each item was preceded by the following instructions: "Imagine that you are offered one the following two alternatives. Something you would get and something other women (men you are dating) would get. Which option would you choose?"

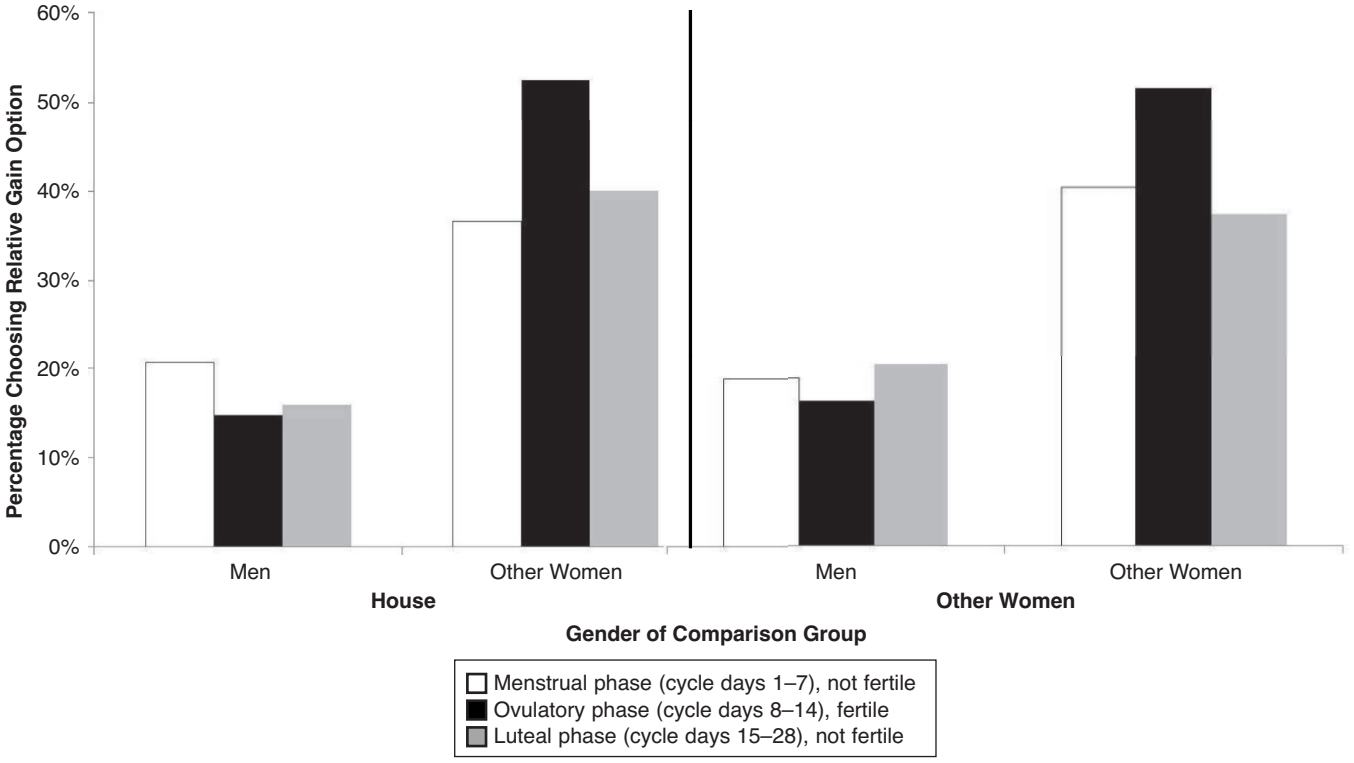
For the house, the options were (A) "You have a $350,000 house; other women (men) have $500,000 houses," or (B) "You have a $250,000 house; other women (men) have $100,000 houses." For the restaurant, the options were (A) "You get to go to a $100 per person restaurant; other women (men) get to go to $150 per person restaurants," or (B) "You get to go to a $75 per person restaurant; other women (men) get to go to $25 per person restaurants." In both choices, whereas Option A represents maximizing absolute gains, Option B represents maximizing relative gains (see Appendix C). The dependent measure was the percentage of women who chose the option that maximized their relative gains.

Results and Discussion

House choice. A repeated measures logistic regression with fertility (high vs. low) and target comparison gender (men vs. women) revealed a significant interaction (B = –.81, Wald = 5.16, d.f. = 1, $p = .023$; see Figure 4). When women compared their house with that of other women, the high-fertility group selected the relative gain option more frequently than did the low-fertility group (52.5% vs. 38.4%, respectively; $\chi^2 = 7.35$, d.f. = 1, $p = .007$, d = .29). However, when women compared their house relative to that of men, there was no difference in choices across fertility ($p = .40$).

Figure 4

PERCENTAGE OF WOMEN SELECTING PRODUCT THAT PROVIDES A RELATIVE (VS. ABSOLUTE) GAIN AS A FUNCTION OF THEIR OVULATORY CYCLE PHASE AND GENDER COMPARISON GROUP (STUDY 2)



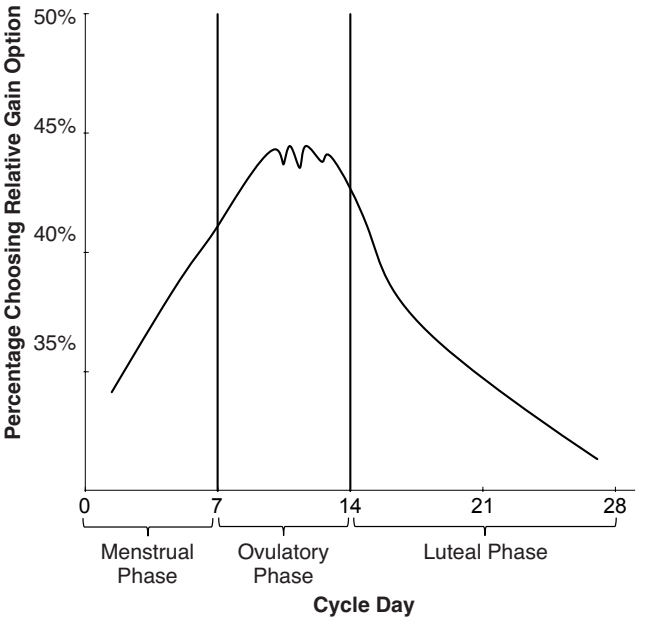
Restaurant choice. A repeated-measures logistic regression revealed a significant interaction between fertility and target comparison gender (B = –.71, Wald = 3.89, d.f. = 1, p = .049; see Figure 4). Again, when women compared their restaurant relative to that of other women, the high-fertility group selected the relative gain option more frequently than did the low-fertility group (46.7% vs. 35.1%, respectively; χ^2 = 5.22, d.f. = 1, p = .022, d = .24). However, when women compared their restaurant with that of men, there was no difference in choices across fertility (p = .44).

As in Study 1, we next examined women's choices relative to women across the full 28-day cycle. Although the curvilinear relation between cycle day and probability of selecting the relative gains option did not reach conventional levels of significance (β = –.27, t(480) = –1.65, p = .10), a visual inspection of the figure suggests that women's preference for the relative gains option again tracked fertility hormones across the cycle (see Figure 5). As in Study 1, women's choices reflecting the desire to outcompete other women seem to be related to the precise pattern of fluctuation of fertility hormones across the menstrual cycle. (For a complete summary, see the Web Appendix.)

Together, these findings conceptually replicate and extend the findings from Study 1, showing that the effect of fertility on women's desire to have relatively more than others is specific to other women. As H_2 predicted, the gender of the comparison group is an important boundary condition for whether ovulation increases women's tendency to opt for relative gains. Consistent with the ovulatory competition hypothesis, ovulation led women to seek relatively more than others only when the comparison group was composed of other women.

Figure 5

LOESS CURVE DEPICTING THE PERCENTAGE OF WOMEN SELECTING PRODUCTS THAT PROVIDE A RELATIVE (VS. ABSOLUTE) GAIN COMPARED WITH OTHER WOMEN ACROSS THE FULL OVULATORY CYCLE (STUDY 2)



Notes: The curve represents an average of the two products (house and restaurant).

STUDY 3: DICTATOR GAME

The ovulatory competition hypothesis suggests that the effect of the ovulatory cycle should manifest itself not only in women's consumer choices but also in their financial decisions that have bearing on other people. Study 3 therefore tests how ovulation affects women's actual behavior in an incentive-compatible dictator game. Importantly, whereas the first two studies assessed women's ovulatory phase using a counting method, Study 3 relies on the most stringent and precise method: urine tests.

As previously explained, in the dictator game, a player is given a fixed amount of money and is tasked with dividing it between herself and another person. The player can give as much or as little of the money to the other person as she dictates. The more the player gives, however, the less money she gets to keep for herself. A meta-analysis of more than 100 dictator game studies indicates that people tend to give approximately 25%–50% of the money to the other person when playing with a stranger (Engel 2011). The meta-analysis also revealed a gender difference, with female dictators typically offering more money than male dictators, and people offering more money to female than male receivers (Engel 2011; also see Saad and Gill 2001a, c).

In Study 3, ovulating and nonovulating women played an incentive-compatible dictator game with either another woman or a man. Consistent with H_3, we predicted that ovulation would lead women to give smaller financial offers to other women but not to men.

Method

Fifty-eight female college students (M_{Age} = 20.5 years, SD = 3.15 years) participated for extra credit and additional cash that they could keep for themselves in line with their choices in the dictator game. The experiment had a 2 (fertility: high vs. low) × 2 (other player: woman vs. man) between-subjects design.

The study used urinalysis to determine fertility status (e.g., Durante et al. 2011; Garver-Apgar et al. 2006; Pillsworth and Haselton 2006). Women reported to the laboratory and completed an over-the-counter urine applicator test (Clearblue Easy Ovulation Test Kit), which tests for a spike in luteinizing hormone (see Figure 1). We used telephone screening interview questions (see Appendix A) to ensure that all participants were ovulating normally and not on any form of hormonal contraception or prescription medication (for a detailed description of the screening process and urinalysis, see Durante, Li, and Haselton 2008). From the telephone interview, women were scheduled to come in on a day near their expected day of ovulation or approximately a week after their expected day of ovulation. Women were told that they needed to complete the urine test so that the researchers would have a better medical assessment of their general health. Although the participants provided the urine sample, trained laboratory research assistants completed the actual reading and recording of test results. Funnel debriefings at the end of the study indicated that none of the participants were aware of the research

hypotheses, and none were aware that the study was examining the effects of the ovulatory cycle.

Women in the high-fertility condition completed the study approximately .29 days before expected day of ovulation. For the low-fertility group, we confirmed low fertility by a poststudy telephone call confirming the start date of their next menstrual period. On average, the nonovulating group completed the study 8.52 days after ovulation.

The female participants played the dictator game on a computer that was ostensibly linked to another player in another room. After sitting down at the computer, participants entered their name and posed for a photo taken by a webcam on top of the monitor. The computer then (ostensibly randomly) assigned participants to the role of Proposer, meaning that their task was to allocate $5.00 between themselves and the other player. The dependent measure was the portion of the $5.00 (entered precisely in dollars and cents) participants gave to the other person, and they got to keep the remainder of the actual money for themselves (see Appendix D).

The female participants were randomly assigned to play against either a man or a woman. Participants were led to believe that the other person was a student at the same university. Before the game began, participants saw a webcam photograph of the other player along with his or her name and year in school. The photographs consisted of two student-aged men and two student-aged women (see Appendix D) who a separate sample of 16 students prerated as slightly above average on attractiveness (M_{Men} = 6.33, M_{Women} = 6.46 on a 1–9 scale). Consistent with previous research using a similar methodology to measure ovulation, we conducted funnel debriefings at the end of the study. Debriefing revealed that all participants believed they were playing against a real person in a nearby room, and none were aware of the research hypotheses.

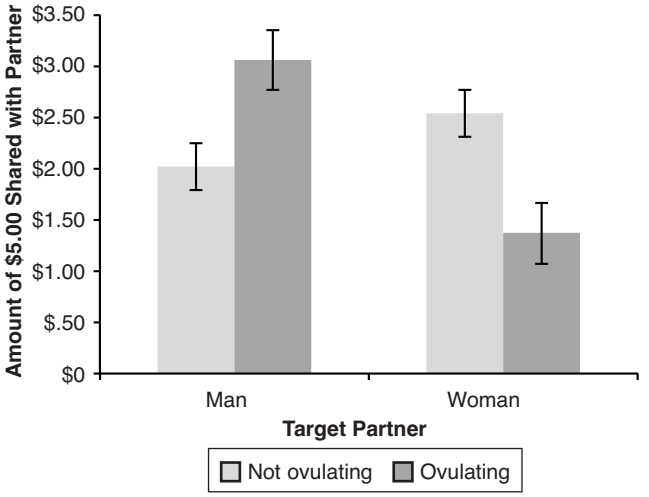
Results and Discussion

Previous research has shown that people tend to offer more money in the dictator game to women than to men (Engel 2011; Saad and Gill 2001a). Consistent with this work, we also found that when women were not ovulating, they gave slightly more money to a woman than to a man ($2.53 vs. $2.02, respectively; p = .13). However, the key question in Study 3 involves how women's decisions might change when they are ovulating.

An analysis of variance with fertility (high vs. low) and partner (man vs. woman) revealed a significant interaction ($F(1, 54) = 15.21$, $p < .001$; see Figure 6). When playing with a woman, ovulating women gave significantly less money than did those who were not ovulating ($M_{High\ fertility}$ = $1.37 vs. $M_{Low\ fertility}$ = $2.53; $F(1, 54) = 9.33$, $p = .003$, d = 1.07). Consistent with H_3, ovulating women gave substantially smaller offers to other women, keeping relatively more money for themselves.

Ovulation, however, did not have the same effect when the woman played with a man. Indeed, women who were ovulating gave significantly more money to a male player than did those who were not ovulating ($M_{High\ fertility}$ = $3.06 vs. $M_{Low\ fertility}$ = $2.02; $F(1, 54) = 6.22$, $p = .016$, d = .99). Unlike their behavior with female players, ovulating women were more generous to men, giving men more than 50% of the endowment. (For a complete summary, see the Web Appendix.)

Figure 6
ENDOWMENT WOMEN GAVE TO A MALE VERSUS FEMALE PLAYER IN THE DICTATOR GAME AS A FUNCTION OF OVULATION (STUDY 3)



The findings support H_3 and conceptually replicate Study 2, showing that ovulation has a different effect on women's decisions depending on whether the decision directly affects other women versus men. Consistent with the ovulatory competition hypothesis, ovulating women chose to keep more money for themselves rather than give it to another woman. In contrast, ovulation did not lead women to behave the same way toward men. Indeed, women actually gave more money to men when ovulating. This generosity toward men may be a reflection of women's increased attraction to desirable men when near ovulation (Anderson et al. 2010; Durante et al. 2012; Haselton and Gangestad 2006). Overall, this sex-specific pattern of findings supports the ovulatory competition hypothesis, suggesting that ovulation leads women to become more competitive against other women but not men.

GENERAL DISCUSSION

Three studies examined how the ovulatory cycle influences women's desire for status. Consistent with predictions derived from the ovulatory competition hypothesis, we found that the ovulatory phase of the cycle increased women's sensitivity to their relative standing compared with other women. Ovulating women were more likely to choose products that provided them with a relative benefit compared with other women rather than products that provided the largest absolute benefit (Study 1). Consistent with the ovulatory competition hypothesis, women's desire to maximize relative gains was specific to gains relative to other women and not men (Study 2). When playing the dictator game, ovulating women kept more money for themselves when playing with a woman but not a man (Study 3). These robust effects emerged both in student samples and in more diverse nonstudent samples, in studies that used within-subject and between-subjects methodologies, and in

studies that assessed fertility using urine applicator tests and a counting estimation method. Indeed, when we collected data across the full 28-day cycle (Studies 1 and 2), the effects of ovulation on decision making tracked the specific pattern of expected hormonal fluctuations across the cycle.

This research contributes to the literature by showing that the ovulatory cycle has important influences on women's behavior. Whereas previous consumer research has found that the ovulatory cycle alters women's clothing and food preferences (Durante et al. 2011; Saad and Stenstrom 2012), we show that the ovulatory cycle has a much broader effect on women's behavior by altering their positional concerns. Ovulating women are motivated to gain status relative to other women, which affects not only their clothing choices but also their economic decisions more broadly.

In addition, the current research shows that ovulation can influence women's behavior beyond enhancing their desirability to men. Previous studies have found that ovulating women opt for sexier clothing (Durante et al. 2011; Durante, Li, and Haselton 2008), which can make them more desirable to men. The current research shows that ovulation can systematically alter women's behavior not necessarily because such behaviors make women more desirable to men but because they increase women's status relative to other women.

Our findings for women are consistent with findings in the animal literature streams. For example, female monkeys become more aggressive toward other females when fertile, but males do not find aggressive females any more desirable than nonaggressive females. Rather, females that are able to successfully intimidate same-sex rivals have better access to males because other females defer to those with higher status or rank. The current studies similarly show that ovulation leads women to desire positional goods. Prior research has shown that luxury products do not enhance women's attractiveness to men (Sundie et al. 2011) and that women use such products primarily as signals to other women (Wang and Griskevicius 2013). Thus, the ovulatory phase of the cycle leads women to jockey for position with other women, which may ultimately increase their access to desirable mates.

Implications

Our findings suggest that, for approximately one week every month, millions of normally ovulating women systematically alter their preferences. This phenomenon has important implications for marketers, researchers, and consumers. For consumers, the findings suggest that monthly hormonal fluctuations might contribute to women's spending on positional goods (e.g., cars, jewelry). The current studies suggest that ovulation may motivate women to seek out and purchase positional goods. Indeed, a recent study has found that ovulating women have better memory for products that are expensive (Lens et al. 2011). Future studies might examine how ovulation influences women's materialism, their spending on luxury goods, and their desire for conspicuous consumption.

For researchers, our findings suggest that future studies might find systematically different effects depending on the mix of women in the study. For example, studies examining women's choices in economic games or desire for status might find different effects depending on where the women are in their menstrual cycle. We recommend that researchers consider controlling for the effects of the monthly cycle. University institutional review boards support this kind of research, and a woman's cycle day can be captured accurately with only three questions that most women are comfortable answering (see Studies 1 and 2). Although the current research finds that women have an increased desire for positional goods specifically near ovulation, it also suggests that competition with rivals underlies women's desire for status. Further research might explore how manipulated cues to competition affect women's consumer choices.

For marketers, knowledge of the effects of the ovulatory cycle on behavior might enable them to use this information strategically. For approximately one week every month, millions of women become more sensitive to attaining relative status. This suggests that ovulating women might be especially responsive to advertising, promotions, and messages that emphasize the positional superiority of a given product. If marketers are unable to ascertain women's cycle information directly, they might nevertheless be able to model a 28-day cycle using individual purchase histories. If so, marketers could use such information in forecast models, and firms might strategically send marketing messages (e.g., on mobile phones) that emphasize female competition specifically when female consumers would be most responsive to such appeals—during the ovulatory phase of their cycle.

Limitations and Future Research Directions

The current studies were inspired by theory and research in evolutionary biology and evolutionary consumer behavior (Durante et al. 2011; Durante, Li, and Haselton 2008; Griskevicius et al. 2009; Griskevicius, Tybur, and Van den Burgh 2010; Miller 2009; Saad 2007; Van den Bergh, Dewitte, and Warlop 2008; Wang and Griskevicius 2013). We derived our hypotheses from the ovulatory competition hypothesis, which asserts that successfully attracting a mate involves outcompeting other females for access to mates. Although we consistently found that ovulation led women to seek goods that improve their standing relative to other women, further research is needed to establish the underlying psychological mechanism driving these effects. It is possible that women become more competitive with other women near ovulation, which would lead them to make choices that would enhance their relative status compared with other women. Further research could examine whether women's positional concerns near ovulation translate across products or whether these concerns are specific to products perceived to signal status to other women. Yet another possibility is that ovulating women might seek positional goods to impress men. Although the ovulatory competition hypothesis suggests that such a possibility is unlikely, further research is necessary to ascertain the psychological mechanism driving the effects found in the current studies.

Given the universal nature of the ovulatory cycle, it is important to determine how this biological factor may affect a wide range of behavior. Although our studies demonstrate that the ovulatory cycle influences women's desire for position goods, it may also affect a wider range of behaviors relevant to marketing, consumer behavior, and decision making. For example, the ovulatory cycle might alter intertemporal choice (Frederick, Loewenstein, and

O'Donoghue 2002; Loewenstein and Prelec 1992). Given the time-sensitive nature of decision making during the cycle, ovulating women might place more value on immediate rewards. The cycle might also influence charitable giving and ethical decisions (e.g., Galak, Small, and Stephen 2011; Irwin and Naylor 2009; Small and Verrochi 2009). For example, given that women become more competitive during the ovulatory phase, ovulating women may be less sensitive to others' needs and more willing to take unethical routes to gain status. The cycle might also affect consumption enjoyment (Nowlis, Mandel, and McCabe 2004) such that the same consumption experience may be more or less enjoyable during different phases of the cycle. Our research also suggests that ovulating women might be more or less responsive to sales requests depending on the gender of the salesperson. Although we found that women gave more to a man and were stingier with another woman in the dictator game, future studies might examine whether varying the attractiveness of the target partner influences how ovulating women respond to sales requests (see Saad and Gill 2001c).

Research on the influences of the ovulatory cycle—and of hormones in general—on business behavior and choice is in its infancy (e.g., Durante et al. 2011; Durante and Saad 2010; Saad and Stenstrom 2012; Saad and Vongas 2009; Stenstrom et al. 2011). The study of how hormones affect marketing phenomena has important implications not only for research and application but also for linking theory and research in marketing with theory and research in biology, animal behavior, and evolutionary psychology.

APPENDIX A: SCREENING QUESTIONS

Instructions: Please answer the following questions. Keep in mind, your answers are completely ANONYMOUS and you may skip any question without penalty.

1. Please indicate your gender:

   ____ Male ____ Female

(All women are taken to the following questions):

2. Are you currently using an oral contraceptive (the "pill" or the "patch") or other hormonal contraceptive (Mirena, Depo-Provera, Norplant, Vaginal Ring)? Yes/No
3. If yes, please select the contraceptive that best matches what you are currently on?

   A. The Pill B. The Patch C. Hormonal IUD (e.g., Mirena) D. Vaginal Ring E. Norplant F. Depo-Provera Shot G. Other

4. If you are not currently using oral or hormonal contraceptives, have you used them within the last 3 months? Yes/No
5. Are you currently pregnant or breastfeeding a child? Yes/No

Use a calendar for the following questions:

6. _____Please give your best estimate of the date on which you started your last period (please be as precise as possible). This date was probably within the last few weeks. Sometimes thinking of where you were when you started your last period helps. For instance, was it on a weekend?, were you in class?, was it during a football game?, etc.
7. _____How sure are you about that date?

   1 2 3 4 5 6 7 8 9
   Not at all Somewhat Completely

8. _____Please give your best estimate of the date on which you started the period before your last period (please be as precise as possible).
9. _____How sure are you about that date?

   1 2 3 4 5 6 7 8 9
   Not at all Somewhat Completely

10. _____What is your best estimate of the date on which you expect to start your next period (please be as precise as possible)?
11. _____How sure are you about that date?

    1 2 3 4 5 6 7 8 9
    Not at all Somewhat Completely

12. _____How many days long are your menstrual cycles? (for most women, the range is between 25–35 days) Keep in mind this is the # of days from the start of one menstrual period to the start of the next menstrual period and NOT the length of your menstrual bleeding.
13. How sure are you about your menstrual cycle length?

    1 2 3 4 5 6 7 8 9
    Not at all Somewhat Completely

14. How well can you predict the date on which you will have another period? That is, how regular is your cycle?

    1 2 3 4 5 6 7 8 9
    Not at all Somewhat Completely

15. _____ [Necessary only if Q14 is LESS THAN 7] By how many days are you usually "off" in your prediction of when you will start your next period?
16. Have you been sick within the past few days? For instance, with the flu or other illness more serious than a common cold? Yes/No
17. To your knowledge, do you currently have or have you previously been diagnosed with an endocrine or hormonal disorder of any kind (e.g., overactive thyroid, polycystic ovarian syndrome, pituitary disorder)? Yes/No
18. To your knowledge, do you currently have a chronic or more serious illness such as cancer, diabetes, or a neurological disease or disorder? Yes/No
19. Are you currently taking any prescription medication? Yes/No If so, please list.

APPENDIX B: STUDY 1 CHOICE OPTIONS

Instructions (Page 1): For the following questions you will be given two alternatives. Please pick the option you would prefer. Remember, there are no right or wrong answers. Click to Continue.

Instructions (Page 2): Imagine that you are offered one of the following alternatives. Something you can get and something other women can get. Which option would you choose?

Choice 1

Option A: You have a $7,000 diamond ring; other women have $15,000 diamond rings.
Option B: You have a $5,000 diamond ring; other women have $1,000 diamond rings.

Choice 2

Option A: You have a $25,000 car; other women have $40,000 cars.
Option B: You have a $20,000 car; other women have $12,000 cars.

APPENDIX C: STUDY 2 CHOICE OPTIONS

Instructions (1): For the following questions you will be given two alternatives. Please pick the option you would prefer. Remember, there are no right or wrong answers. Click to Continue.

Instructions Women Target (2): Imagine that you are offered one of the following alternatives. Something you can get and something other women can get. Which option would you choose?

Choice 1

Option A: You have a $350,000 house; other women have $500,000 houses.
Option B: You have a $250,000 house; other women have $100,000 houses.

Choice 2

Option A: You get to go to a $100 (per person) restaurant; other women get to go to $150 restaurants.
Option B: You get to go to a $75 (per person) restaurant; other women get to go to $25 restaurants.

Instructions Men Target (3): Imagine that you are offered one of the following alternatives. Something you can get and something men you are dating can get. Which option would you choose?

Choice 1

Option A: You have a $350,000 house; men you are dating have $500,000 houses.
Option B: You have a $250,000 house; men you are dating have $100,000 houses.

Choice 2

Option A: You get to go to a $100 (per person) restaurant; men you are dating get to go to $150 restaurants.
Option B: You get to go to a $75 (per person) restaurant; men you are dating get to go to $25 restaurants.

APPENDIX D: STUDY 3 INSTRUCTIONS AND STIMULI

Instructions: For this part of the study, you will be participating with participants from another study. Because you will be paired with other participants, this computer is set up to a network that links this computer with computers on other floors of the building.

When you click CONTINUE you will first have your picture taken and be asked to input your name and year in school. This information will be used when the computer links to your study task partners. Please click to continue.

Please type in your first and last name followed by your year in school. For example: Jane Smith, Freshman

Thank you! Your picture and information have been imported.

Today you will take part in a decision-making game with assigned partners who are participating in a separate study. For this task, either you or your partner will decide how to allocate a cash prize of $5.00 (a prize that will be awarded at the end of study participation).

You will either be assigned the role of Receiver or the role of Proposer. If you are assigned the role of Proposer, you will decide how much of the $5.00 you will give to the Receiver. In other words, the Proposer can allocate any portion of the $5.00 to the Receiver.

If you are the Proposer, your earnings at the end of the study will be $5.00 MINUS the amount specified to the Receiver.

If you are the Receiver, your earnings at the end of the study will be the amount specified by the Proposer.

Please click to find out your role assignment.

Congratulations! You have been assigned the role of the PROPOSER.

At this point, we need to link this computer (#036) to a computer on the 3rd floor. The computer will randomly link this computer to a participant who is participating in a separate study. This person will be your partner for the decision task.

Please click continue to begin this process and link to your partner.

Your partner in the role of Receiver is: (Participants saw one of the four names and photographs)

Male Target 1:
Location: Computer #049
Name: Todd Anderson
Year at UMN: Senior

Male Target 2:
Location: Computer #042
Name: David Miller
Year at UMN: Junior

Female Target 1:
Location: Computer #075
Name: Sue Jacobson
Year at UMN: Sophomore

Female Target 2:
Location: Computer #054
Name: Samantha Johnson
Year at UMN: Sophomore

In the blank space below, please indicate how much of the $5.00 cash prize you would like to share with (Name of Partner). Keep in mind that the amount you share can range from $0.00 to $5.00 and (Name of Partner) will be notified of your decision once it has been made.

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Money, Status, and the Ovulatory Cycle

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WEB APPENDIX

TABLE 1

Study 1. Logistic regressions for each product with Fertility (Ovulating vs. Not Ovulating) as a dichotomous, between-subjects factor.

Product	Fertility	*% Relative Gain*	*B*	*SE*	*Wald*	χ^2
Ring	Ovulating	42.5%	.602	.269	5.00*	4.93*
	Not Ovulating	28.8%				
Car	Ovulating	35.0%	.735	.286	6.61**	6.43*
	Not Ovulating	20.5%				

Study 1. Linear regression for the percentage choosing the relative benefit option with the linear and quadratic terms for cycle day.

Cycle Day	β	*SE*	*F*	*t*
Linear:	.391	.011	1.502	1.65
Quadratic:	-.475*	.000	2.764	-2.003*

*$p < .05$, **$p \leq .01$, ***$p \leq .001$

TABLE 2

Study 2. Repeated measures logistic regression for each product with Gender of Comparison Group (Women vs. Men) and Fertility (Ovulating vs. Not Ovulating) as a dichotomous, between-subjects factor.

Product	**Source**	***B***	***SE***	***Wald***	χ^2
House	Fertility	1.384	.269	7.292**	2.485
	Target Gender	-1.04	.175	35.279***	70.605***
	Fertility x Target Gender	-.814	.359	5.155*	
Restaurant	Fertility	1.193	.515	5.372*	1.668
	Target Gender	-.913	.177	26.70***	53.13***
	Fertility x Target Gender	-.709	.360	3.89*	

Study 2. Linear regression for the percentage choosing the relative benefit option by target gender with the linear and quadratic terms for cycle day.

Target Gender	**Cycle Day**	β	***SE***	***F***	***t***
Women	Linear:	.253	.009	.265	1.457
	Quadratic:	-.287†	.000	1.495	-1.650†
Men	Linear:	-.217	.007	.051	-1.247
	Quadratic:	.214	.000	.782	1.230

†$p \leq .10$; *$p \leq .05$, **$p \leq .01$, ***$p \leq .001$

Table 3

Study 3. ANOVA for percentage of money shared with Fertility (Ovulating vs. Not Ovulating) and Target Gender (Man vs. Woman) as dichotomous, between-subjects factors.

Source	***df***	***F***
Fertility	1	.042
Target Gender	1	4.417*
Fertility x Target Gender	1	15.208***
Error	54	

Simple Effects for Fertility (Ovulating vs. Not Ovulating) and Target Gender (Man vs. Woman).

Source	***df***	***F***
Man (Ovulating vs. Not Ovulating)	1, 54	6.221*
Woman (Ovulating vs. Not Ovulating)	1, 54	9.331**
Ovulating (Man vs. Woman)	1, 54	13.605***
Not Ovulating (Man vs. Woman)	1, 54	2.39

*$p \leq .05$, **$p \leq .01$, ***$p \leq .001$

Means for Fertility and Target Gender.

Fertility	**Target Gender**	***Mean***	***SD***
Not Ovulating	Man	$2.02	$0.87
	Woman	$2.53	$0.76
Ovulating	Man	$3.06	$1.21
	Woman	$1.37	$1.33

Means for Target Gender.

Target Gender	***Mean***	***SD***
Man	$2.31	$1.06
Woman	$2.05	$1.17

Means for Fertility.

Target Gender	***Mean***	***SD***
Ovulating	$2.05	$1.51
Not Ovulating	$2.25	$0.85