THE EFFECT OF COMPETITION ON MEN'S SEXUAL BEHAVIOR

by

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ABSTRACT

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Evidence in humans suggests that men are especially competitive with other men over resources and, if successful, are valued as attractive mating prospects by women. Previous studies also show that men experience an increase in testosterone following a win and a decrease in testosterone following a loss. If an increase in testosterone following a victory is an evolved physiological response aimed at readying a man for an increase in mating opportunities, then experimentally manipulating competitive outcomes should differentially affect men's sex-drive. One-hundred thirteen men were randomly assigned to experience a win, a loss, or no competitive feedback. Participants' sex-drive was gauged by their responses to photographs of women of differential attractiveness. Results showed that only single men exhibited a higher sex-drive in the winning condition, followed by the control and losing conditions, respectively. Limitations and practical applications to decreasing instances of rape and sexual coercion are discussed.

THE EFFECT OF COMPETITION ON MEN'S SEXUAL BEHAVIOR

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The Effect of Competition on Men's Sexual Behavior

The present study aims to uncover whether and to what degree the manipulation of men's social status affects their sexual motivation and interest. In line with previous research in humans and other primates showing a relationship between social status, testosterone level, and sexual behavior, I hypothesize that by experimentally manipulating male participants' self-perceived social status, a concomitant change in their sexual motivation and interest will be observed. More specifically, I predict that an increase in a male participant's self-perceived social status (resulting from a victory in a competitive task against another man) will cause an increase in his sexual motivation and interest. Likewise, I predict that a decrease in a male participant's self-perceived social status (resulting from a loss in a competitive task against another man) will cause a decrease in his sexual motivation and interest. The rationale for these predictions stems from the evolutionary biological concepts of sexual selection, the extended phenotype, life history theory, and the challenge hypothesis, as discussed in the ensuing sections.

Selection within a Biological Context

Natural selection ensures that organisms are adapted to both animate and inanimate aspects of their environments. Thus, not only are biological adaptations selected to exploit geological and meteorological resources, organisms also possess adaptations that enable them to interact with other organisms, whether of the same or of a different species. Humans are no different. Our evolution includes a history of selection

pressures stemming from non-biological sources such as the degree of sunlight to which our ancestors were exposed (Jablonski & Chaplin, 2000), the types of landscapes they traversed (Cerling et al., 2011), and the composition of the air they breathed (Beall, 2006). In addition to the adaptations sculpted by these non-living factors in our species' ancestral environments, humans, like all other organisms, also possess adaptations that were selected to deal with the presence of countless biological forms, from viruses and bacteria (Aidoo et al., 2002), to plants and animals (Cochran & Harpending, 2009; Holden & Mace, 1997). As social primates, ancestral humans were also subject to the selection pressures stemming from other humans with whom they interacted (Bailey & Geary, 2009; Brüne & Brüne-Cohrs, 2006). Therefore, our ancestors' bodies and minds had to contend with the presence of the bodies and minds of their conspecifics in order to survive and reproduce, and their survival and reproduction depended on their ability to cooperate as well as compete with their conspecifics. Of course, these conspecifics were under similar selection pressures to successfully navigate their social environments as well. This dynamic interplay between the needs of our ancestors to cooperate and/or compete with one another may have been a primary factor responsible for the evolution of the enlarged human brain (Bailey & Geary, 2009). Thus, coevolutionary relationships between our ancestors and their conspecifics, whether mutualistic, commensal, predatory, or parasitic, cannot be overlooked in evolutionary examinations of human social and sexual behavior.

Sexual Selection

A sexually reproducing organism's evolutionary success is not only dependent on its ability to survive but also on its ability to reproduce. For example, a male who lived

for 100 years but who fathered no children (nor possessed any genetic relatives who themselves reproduced), would be an evolutionary dead-end, as none of his genes would be represented in subsequent generations. In contrast, a man who lived only for 25 years but who was successful at conceiving many children (and/or helping his genetic relatives to rear theirs), would thereby propagate his genes into the next generation and pass on his reproductively successful traits to his offspring. This is an important distinction, as evolutionary success is more dependent on reproduction than it is on survival. In sexually reproducing organisms such as humans, reproductive success rests on an individual's ability to outcompete sexual rivals and procure access to mates—a process that (Darwin, 1859/2006) termed "sexual selection." In contrast to natural selection, which entails that adaptations are selected because they help their bearers to survive, sexual selection entails that some adaptations of sexually reproducing organisms are selected because they help their bearers to reproduce.

Because successful reproduction often depends on the dual process of outcompeting sexual rivals and attracting mates, sexual selection can be subdivided into *intrasexual* selection and *intersexual* selection, respectively (Darwin, 1871/2006). Across species, intrasexual selection often involves competition between rival males. The reason for this is that, for males, the benefits of competition over mates outweigh the costs (Trivers, 1972). Because females usually bear the burdens of gestation, lactation, and childrearing, their reproductive success does not increase with repeated copulations. Males, however, can increase their reproductive success via copulations with many females. Thus, the burdens of reproduction are felt almost entirely by females, who become a scarce reproductive resource over which males compete—often violently, as in

elephant seals, gorillas, and bighorn sheep (Breuer, Robbins, & Boesch, 2007; Coltman, Festa-Bianchet, Jorgenson, & Strobeck, 2002; Galimberti, Sanvito, Braschi, & Boitani, 2007). Violent male-male competition in a species often leads to sexual dimorphism (i.e., a physical differentiation between males and females). This occurs because males who are physically larger and stronger—traits associated with success in violent competition against reproductive rivals—are selected across generations over their smaller and weaker rivals. In our own species, for example, the average physical strength of men is greater than that of women (Frontera, Hughes, Lutz, & Evans, 1991), suggesting a history of moderate physical competition between ancestral men. With regard to the present topic, it is possible that men may also compete with one another in the realm of physiological competition. More specifically, a man may seek to decrease the sexual motivation and interest of a sexual competitor (e.g., by decreasing his social status), and thereby reap the reproductive benefits of gaining uncontested sexual access to a woman.[1]

In contrast to intrasexual selection, which entails that reproductive success depends on outcompeting members of one's own sex, intersexual selection entails that reproductive success depends on attracting members of the other sex. Intersexual selection is often referred to as "female choice" because, in most species, females are usually in charge of when, where, and with whom they copulate. This evolutionary outcome stems from the greater female obligatory investment in reproduction (Trivers,

[1] Such an instance of physiological manipulation may be an example of Dawkins's (1982) concept of the extended phenotype. Usually, the concept of the phenotype is restricted to an organism's body (e.g., its organs, limbs, genitalia, etc.), which is a product of its genes and its non-genetic environment. However, organisms may also possess adaptations that transcend their physical bodies. Tools and environmental modifications such as beaver dams are examples of such extended phenotypes. Likewise, organisms may use other organisms as extended phenotypes, as when a virus parasitically manipulates its host to engage in bouts of coughing and sneezing near other potential hosts. It is possible that men may manipulate their reproductive competitors in this manner by decreasing their competitors' sexual motivation and interest, a possibility implied by the current study.

1972). For example, if a female copulates with a male who is of low genetic quality or who is unwilling or unable to assist in childrearing, she risks squandering her scarce reproductive resources on offspring who are of low genetic quality themselves or who lack the paternal care necessary for survival. Therefore, females across different species have evolved stringent mate selection criteria that are responsible for the evolution of physical and psychological characteristics in males. Some of these characteristics include gaudy and colorful ornaments (Hill, 1991), elaborate mating calls (Ballentine, Hyman, & Nowicki, 2003), complex acrobatics (DuVal, 2007), high energy-consuming behaviors such as bower construction (Uy & Borgia, 2000), and, as is the case in humans, the willingness to apportion paternal care (Geary, 2000). That females are attracted to males who can produce such costly ornaments or deploy such time and energy-consuming behaviors suggests that there is a reproductive benefit to mating with these males (Zahavi, 1975). Indeed, a male who is able to produce and maintain a costly ornament such as a heavy and cumbersome tail may communicate his quality by flaunting it in front of females. In contrast, males of low quality may be vulnerable to pathogens, parasites, and predators by attempting to produce such costly signals. Once sexual selection produces costly signals, females will mate with the males who brandish them because these males are likely to sire attractive sons who will spread their mothers' genes (Gwinner & Schwabl, 2005).

There is evidence that human males may possess traits that were intrasexually selected across generations of evolutionary history (see the following section). One such trait entails a willingness to compete for social status with other men. These competitions are not restricted to physical combat but may also include displays of economic resources

(Miller, 2000), both of which may function as honest signals of social status to women. Furthermore, a man's sex-drive may be sensitive to changes in his social status by either increasing or decreasing as a function of either victory or loss in competitive contexts with other men, respectively (see the *Male Social Status, Testosterone, and Sexual Behavior* section). The reason for this is that intrasexual competition and courtship are costly behaviors, and ancestral men may have been selected to engage in these behaviors only when their reproductive prospects were moderate to high—as would occur during an increase in their social status. Therefore, a decrease in sex-drive may be an evolved response on the part of a losing competitor whose reproductive prospects are suddenly lowered and whose energy may be more productively spent in contexts in which he is unlikely to sustain further damage from a superior competitor or be rejected by a female because of his inferior social status (see the subsequent discussion of life history theory). However, as would be predicted by the extended phenotype concept (Dawkins, 1982), this physiological response may be taken advantage of by men who seek to lower their sexual competitors' sex-drive by attacking their social status. In short, intrasexual competition between males may not only occur at the level of resource acquisition but also at the level of sexual physiology, whereby males compete to lower each others' sexual interest and motivation. Needless to say, organisms (humans included) are usually not conscious of their genetic interests while competing for mates or exhibiting sexually selected behaviors.

Social Status and Sexual Selection in Humans

In line with the theory of sexual selection, there is evidence that human males engage in intrasexual competition over social status. For instance, men allocated fewer resources to other men, were more prosocial toward women, and reported a high degree of intrasexual competitiveness on a resource allocation task (Buunk & Massar, 2012). In contrast, women's allocation decisions were not influenced by the perceived sex of the other player. It is possible that because women find men who have resources (and, thus, who are of a high social status) attractive, intrasexual competition between men occurs mostly in the realm of resource acquisition. That men target other men's resource holdings in contexts of intrasexual competition is highlighted by the fact that men are more likely to derogate other men's resources, goals, and achievements, whereas women are more likely to derogate other women's sexual behavior and appearance (Buss & Dedden, 1990). Competitor derogation thus appears to be a process by which individuals manipulate the mate choice of their opposite-sex targets—in effect, lowering the perceived mate value of their intrasexual competitors while enhancing their own. In what follows, I hypothesize that in contexts of intrasexual competition, the lowering of a male's self-perceived social status may directly lead to a lowering of his sexual motivation and interest.

In addition to intrasexual selection of male social status-seeking behavior, there is evidence that women find status-seeking behavior attractive in men. For example, Buss's (1989) cross-cultural survey of 37 societies revealed that women placed greater value than men on social status-signaling traits such as good financial prospects, earning capacity, and ambition/industriousness in romantic partners. Similarly, women place

greater value than men on trait dimensions such as status/resources and education/intelligence in long-term romantic partners (Shackelford, Schmitt, & Buss, 2005). That women prefer men who are of a high social status is likewise evident from the finding that women expect to be more upset by a potential romantic partner's lying about his social status and resource holdings than by other types of deception (Haselton, Buss, Oubaid, & Angleitner, 2005).

Men do not value social status in potential partners as much as women. For example, whereas socioeconomic status (SES) is ranked by both sexes as an important criterion on which to judge long-term romantic partners, men tend to prefer women who are lower in SES than they are, whereas women tend to prefer men who are higher in SES than they are (though these effects are mediated by the educational factors of SES rather than by income; Greitemeyer, 2007). Greitemeyer suggests that this finding is explained by the potential threat that an educated woman poses to a man's reproductive interests, as she may be more likely to get away with deceiving and cuckolding her partner (but see Goetz, Easton, Lewis, & Buss, 2012, who argue that in contrast to long-term mating contexts—where intelligence is valued by both sexes—men may preferentially target women of low intelligence because they are easier to sexually exploit in short-term mating contexts). However, because a man's SES (which includes his level of education) is an important indicator of his ability to expend resources on a woman and her offspring, a woman will likely value a potential romantic partner's SES to a greater extent than does a man. This is highlighted by the finding that physically attractive women are more likely to have higher standards than less attractive women for a potential romantic partner's income, earning capacity, education, age, and physical attractiveness (Buss &

Shackelford, 2008). Taken together, these studies suggest that women are sexually attracted to men of high social status, a trait that is often gauged by socioeconomic and resource-holding cues.

From an evolutionary perspective, women who were mated to men of high social status may have been more reproductively successful than women who were mated to men of low social status. Such instances of intersexual selection are evident in both short- and long-term mating contexts, as women value social status in both short- and long-term romantic partners (Li, 2007). The reason for this may be that social status functions as both a signal of genetic health (in that men who are physically and psychologically healthy are also more likely to acquire resources and achieve social standing) and an ability to invest resources in a woman and her offspring. In what follows, I discuss the possibility that men's intrasexual competition over social status may function to alter their own and other men's sexual motivation and interest, in addition to whatever survival and reproductive benefits are accrued as a result of an increase in social status (e.g., in addition to an increase in the amount of nutritional, monetary, or luxury resources).

Male Social Status, Testosterone, and Sexual Behavior

In studies across widely differing vertebrates, there are correlations between male social status, testosterone level, and sexual behavior. For example, in the African cichlid *Astatotilapia burtoni*, testosterone level was shown to be correlated with male dominance and monopolization of a territory and its females (Parikh, Clement, & Fernald, 2006). The proximal mechanisms underlying the relationship between testosterone and dominance entail increases and decreases in the size and output of gonadotropin-releasing hormone (GnRH) neurons in the hypothalamus of male cichlids (Fernald, 2007). In all

vertebrates (including humans), GnRH neurons are responsible for triggering the release of gonadotropins by the pituitary, which, in turn, leads to testes growth and the release of androgenic hormones such as testosterone. When a male cichlid ascends in social rank, GnRH neurons in the preoptic area (POA) of the hypothalamus increase in size and in output of GnRH into the pituitary (Francis, Soma, & Fernald, 1993; White, Nguyen, & Fernald, 2002). However, when a male descends in social rank, the same neurons decrease in size and lower their output of GnRH. What is interesting about this cichlid is that the reaction of these neurons to a male's variation in social status is less sensitive during decreases in social rank than increases in social rank. That is, the size of the GnRH neurons is immediately increased upon a male's ascent in social rank, but it takes some time for the same neurons to decrease in size upon a male's defeat (although the defeated male is quick to decrease his behavioral dominance), which may be explained by the potential for a defeated male to regain his social status and retain his privileged reproductive position (White, Nguyen, & Fernald, 2002). In contrast, the GnRH neurons of an ascending male are immediately increased in size because he has to immediately seize the reproductive opportunities of his newly-gained social status.

Life history theory (LHT; Ellis, 2004; Hill & Kaplan, 1999) may help to explain this sensitivity of male hormones to contextual life circumstances. According to LHT, natural selection ensures that organisms allocate their time and metabolic resources in an evolutionarily adaptive manner across the life-span. These allocation-of-energy decisions often center on the tradeoff between investing in current versus future reproduction, and may be sensitive to contextual circumstances. For example, by ascending in social rank, a male cichlid is environmentally primed to invest in current reproductive effort by

increasing his testosterone production, which enables the male to take advantage of his newly-gained social status. By descending in social rank, however, a male is environmentally primed to invest in future reproductive effort by decreasing his testosterone production—a response that saves the male from violent territorial competition with other, more socially dominant males, from the risk of wasting time, resources, and further social standing by pursuing females who are not interested in him, and from the immunosuppressive effects of testosterone (Alonso-Alvarez, Bertrand, Faivre, Chastel, & Sorci, 2007).

The relationship between male social status and testosterone level is also evident across primate species. For instance, high ranking male mangabeys exhibited greater testosterone levels than low status immigrant males (Arlet et al., 2011), and dominant rank among male chimpanzees is directly associated with testosterone level (Muehlenbein & Watts, 2010). Although these studies are correlational, the causal relationship between sex hormones such as testosterone and social status appears to be bidirectional in that the vagaries of rising and falling social status may affect the concomitant rise and fall of testosterone and, reciprocally, the rise and fall of testosterone may lead to a rise and fall in social status.

This dynamic has likewise been observed in humans. For example, victories in competitive contexts such as basketball games (Gonzalez-Bono, Salvador, Ricarte, Serrano, & Arnedo, 2000), chess tournaments (Mazur, Booth, & Dabbs Jr., 1992), and chance-based laboratory competitions (Gladue, Boechler, & McCaul, 1989), led to a spike in men's testosterone levels, while losses were associated with a decrease in testosterone. Additionally, being on the winning side of a competition without personally

contributing to the victory has been shown to function as a vicarious booster of social status (Cialdini et al., 1976). Therefore, it is no surprise that male sports fans and political voters exhibited an increase (or no change) in testosterone levels upon the victory of their respective teams and candidates and a drop in testosterone when their teams and candidates lost (Bernhardt, Dabbs Jr., Fielden, & Lutter, 1998; Stanton, Beehner, Saini, Kuhn, & LaBar, 2009). The *challenge hypothesis* may explain some of these effects. According to the challenge hypothesis (Archer, 2006; Saad & Vongas, 2009), male testosterone levels increase during periods of intrasexual competition and during encounters with sexually receptive females, as testosterone is linked to both intrasexual competitiveness and sexual behavior. To the extent that testosterone is positively associated with sexual behavior (Rupp & Wallen, 2007), a man's victory in a social-status competition may lead to an increase in his testosterone, which prepares him for the likelihood of greater access to sexually receptive women. The latter possibility is supported by Saad and Vongas's (2009) study showing that when men's social status is inflated by the driving of a luxury automobile, their testosterone levels increase—as would be expected from the finding that women are more attracted to men who drive luxury automobiles (Dunn & Searle, 2010). That men's social status and sexual behavior are linked is evidenced from a series of post-US election studies (Markey & Markey, 2010, 2011) showing that rates of internet pornography searches increased in states that overwhelmingly voted for winning candidates and decreased in states that overwhelmingly voted for losing candidates (as tracked across presidential and congressional elections). That vicariously winning or losing a competition can have such an effect on (presumably) men's sexual motivation and interest suggests that an

experimental manipulation of a firsthand victory or loss may produce an even larger effect on men's sexual motivation and interest.

The Present Study

In the current study, I predicted that after experimentally priming men with experiences of either winning or losing a competition against another man, men in the winning condition would show a greater sex-drive than men in the losing condition, as gauged by their responses to women's photographs. I also predicted that men who did not experience a competitive outcome would show a sex-drive level intermediate between that of men in winning and losing conditions. Although there is evidence that mate preferences correspond to an individual's stable *and* context-dependent mate value (Burley & Foster, 2006; Fink, Neave, Brewer, & Pawlowski, 2007; Gangestad, Haselton, & Buss, 2006), I predicted that a win or a loss in a competitive task would affect men's overall *sex-drive* (greater sexual interest for men in the winning condition, lesser sexual interest for men in the losing condition), rather than just mate preferences *per se*. This prediction is based on the previously discussed effects of testosterone. Although testosterone was not currently measured, Gladue and colleagues' (1989) "competitive" task (see *Methods*), which previously showed differences in participants' testosterone levels following differential competitive outcomes, was adapted for the present study. Therefore, I predicted that competitive outcomes would influence changes in men's sex-drive via changes in their testosterone. To control for participants' mate preferences, however, participants were asked to rate their sexual interest in women of high attractiveness as well as women of low attractiveness. Furthermore, because testosterone and mate-seeking behavior has been shown to decline in men who are in committed long-

term relationships and in men who become fathers (see Gettler, McDade, Feranil, & Kuzawa, 2011, Gettler, McDade, & Kuzawa, 2011, Gray, Kahlenberg, Barrett, Lipson, & Ellison, 2002, Gray, Yang, & Pope Jr., 2006, Kuzawa, Gettler, Muller, McDade, & Feranil, 2009, McIntyre et al., 2006, Pollet, van der Meij, Cobey, & Buunk, 2011, and van Anders & Watson, 2006), a measure of participants' relationship status was also included.

The above predictions stem from the previously-mentioned studies linking men's competitive outcomes to their testosterone level (see Gonzalez-Bono et al., 2000, Gladue et al., 1989, Mazur et. al, 1992, Bernhardt et al., 1998, Stanton et al., 2009, and others) and from Markey and Markey's (2010, 2011) report of overall changes in pornography viewership by US state following the outcome of political elections. The present study aims to fill a gap in the research on the effects of social status manipulation on men's sex-drive. More specifically, although Markey and Markey's naturalistic observations uncovered a connection between election outcomes and pornography viewership, and although there are a host of experimental studies demonstrating the effects of competitive outcomes on male testosterone levels, I am not aware of any direct experimental effects of competition on male sex-drive.

Sex-drive measures. Two measures of sex-drive were presented to participants—a measure of their own sex-drive as it relates to women pictured in photographs (Participant Sex Drive) and a measure of their attribution of sex-drive to the same women (Target Sex Drive). That Target Sex Drive may be indicative of participants' sexual interest is predicted by error management theory (EMT; Haselton & Buss, 2000), which states that men's reproductive interests are best served by erring on the side of perceiving

more sexual interest in women than there may actually be. Therefore, assuming that men's over-perception of women's sexual interest reflects their own sexual interest, I predicted an increase in participants' attribution of sexual interest to women as a function of winning an intrasexual competition against a reproductive rival.

Methods

Population

One-hundred-thirteen male undergraduates (age $M = 19.59$, $SD = 3.4$; 16 participants failed to report their age) from a public university in the Southeastern US were recruited from Introduction to Psychology courses and given course credit for participation. Of the initial 113 participants, 17 had to be excluded from the sample due to either guessing the study's hypothesis or failing to follow instructions (14 participants), for having a sexual orientation that was other than "straight" or "heterosexual" (3 participants—one of whom was also included among the previously mentioned 14 "guessers"), or for computer error (1 participant), yielding a total of 96 participants. An additional 2 participants did not finish the Participant Sex Drive portion of the questionnaire (see below) due to computer error.

Materials

Participants were asked to engage in a computer-based, button-pressing reaction-time task (adapted from Gladue, Boechler, & McCaul, 1989) as a manipulation of competitive priming on participants' sexual motivation and interest. Upon completion of the reaction-time task, participants were asked to answer a series of Likert-type questions (presented on a computer monitor). All of the questions pertained to photographs of women's faces ($n = 4$), divided into two groups of high attractiveness and low

attractiveness, as previously measured on a 1-10 Likert-type scale by university students (N = 45, 29 female; of the initial 10 photographs, the two highest rated were used as the high attractiveness targets and the two lowest rated were used as the low attractiveness targets. Photographs were obtained from the FACES database, compiled by Ebner, Riediger, and Lindenberger (2010; see Figure 1). Each participant was presented with two of the four photographs (one of high attractiveness and one of low attractiveness) and asked the same set of questions regarding each photograph.

Procedure

Upon arrival, participants were told that they would undergo a series of tests that would measure their reaction time and their ability to read facial expressions. Participants were randomly assigned to one of three between-subject groups (two experimental, one control; winning group: n = 32; losing group: n = 28; control group: n = 36). Participants in the experimental groups were primed with an intrasexual competition scenario by being told that they were competing for the fastest reaction time with another male participant from a different university who was matched to them on age and college grade level (e.g., freshman, sophomore, etc.) and whose photograph they were shown. Participants in the control group were not told that they were competing with another participant. Following a modified version of Gladue, Boechler, and McCaul's (1989) manipulation of competitive outcomes, all participants were seated at a computer monitor and underwent a series of five rounds of five trials (for a total of 25 trials) in which they were asked to press a button as fast as they could following presentations of the words "WAIT," "READY," and "GO!". Participants were provided with either "winning" or "losing" feedback after each set of five trials, and with an overall "winning" or "losing"

score upon completion of the reaction-time task. Feedback was given in the form of comparisons between each participant's and his "competitor's" reaction times, which were randomly chosen and kept constant across participants (but reversed between participants in the winning and losing conditions). Participants in the control group received no such feedback, though they also engaged in the button-pressing task. Participants assigned to the "winning" experimental group were told that their reaction time was significantly faster than their competitor's, whereas participants in the "losing" experimental group were told that their reaction time was significantly slower than their competitor's. Depending on condition, participants were either told that they won 4 of the 5 rounds (winning group) or that they lost 4 of the 5 rounds (losing group).

All participants were then asked to participate in a "facial-expression-reading task," which ostensibly had no connection to the reaction-time task. In fact, the facial-expression-reading task was used to gauge participants' sexual motivation and interest by measuring their attribution of sexual interest to women presented in photographs (Target Sex Drive; this measure was used to test the predictions of error management theory) and participants' sexual motivation in response to these photographs (Participant Sex Drive). Complete lists of the questions for the Target Sex Drive questionnaire and the Participant Sex Drive questionnaire are presented in Tables 1 and 2, respectively. To reduce the likelihood of demand characteristics, the Target Sex Drive questionnaire contained randomized sex-drive-related and non-sex-drive-related questions, and was always administered before the Participant Sex Drive questionnaire (with one exception—the Participant Sex Drive question "How attractive is this woman?" was presented in the Target Sex Drive questionnaire). Examples of sex-drive-related questions included:

"How sexually aroused is this woman?" and "How interested is this woman in having sex?" Non-sex-drive-related questions included: "How happy is this woman?" and "How adventurous is this woman?" The Participant Sex Drive questionnaire, on the other hand, only contained sex-drive-related questions. These were administered in order of increasing sexual explicitness, starting with sexually-indirect questions (e.g., "How likely are you to ask this woman out on a date?" and "How likely are you to approach this woman in a bar?"), and proceeding with more sexually-direct questions (e.g., "How sexually 'turned on' are you by this woman?" and "How interested are you in having sex with this woman?"), both of which aimed to directly measure the participant's own sexual interest and motivation. All answers were provided on a Likert-type scale, ranging from 1 (*not at all*) to 8 (*very*). Every participant rated one high attractiveness woman and one low attractiveness woman. Photographs were counterbalanced and questions were randomized within the Target Sex Drive questionnaire.

Upon completion of the facial-expression-reading task, participants were asked to complete a demographics questionnaire (measuring age, relationship status, race, sexual orientation, and estimated self and parental household income; see Table 5), questioned as to whether they had guessed the study's hypothesis or the fabricated nature of the competitive, button-pressing task, and subsequently debriefed. Relationship status was measured via a "yes" or "no" answer to the question "Are you currently in a sexually-active relationship?" (winning group: 14 mated, 18 single; losing group: 13 mated, 15 single; control group: 13 mated, 23 single).

Results

The data were first submitted to a factor analysis to determine if the classification of questions into Participant Sex Drive and Target Sex Drive was defensible. We then examined differences in the mean ratings for the Target Sex Drive questions as a function of condition (winning vs. losing vs. control), target attractiveness (high attractiveness vs. low attractiveness), and relationship status of the participant ("mated"—i.e., in a relationship—vs. "single"). This was followed by a similar analysis of Participant Sex Drive.

Factor Analysis

Participants' rating data were initially submitted to factor analyses, conducted separately for the high-attractiveness and low-attractiveness ratings. Factors were extracted with principal component analysis, using Varimax rotation with Kaiser Normalization. Four identical factors with eigenvalues greater than 1 were extracted from both high-attractiveness target questions and low-attractiveness target questions. The four identical factors included "Participant Sex Drive," "Target Positive Characteristics," "Target Sex Drive," and "Target Conscientiousness," with eigenvalues 5.94, 2.83, 1.48, and 1.73 for high-attractiveness questions and 5.51, 2.45, 1.52 and 1.07 for low-attractiveness questions, respectively. Low-attractiveness questions had an additional "Target Positive Affect" factor (eigenvalue 1.35). Across both sets, all sex drive (participant + target) questions had high loadings on the first factor ("Participant Sex

Drive"), accounting for 37.10% of the variance in high-attractiveness questions and 34.44% of the variance in low-attractiveness questions. Questions pertaining to target "intelligence" and qualities such as being "hardworking," "artistic," and "courageous," all loaded highly on the second factor ("Target Positive Characteristics"), accounting for 17.7% of the variance in high-attractiveness questions and 15.29% of the variance in low-attractiveness questions. Questions pertaining to target "arousal" and target "interest in sex" had the highest loadings on the third factor ("Target Sex Drive"), explaining 9.24% of the variance in high-attractiveness questions and 9.49% of the variance in low-attractiveness questions. Therefore, separating each measure by "Participant" and "Target" sex-drive categories was warranted (see Tables 1 and 2 for Target and Participant Sex Drive questions, respectively).

Target Sex Drive

Target Sex Drive was calculated as the average of two questions measuring the amount of sexual interest that participants assigned to targets on an 8-point Likert-type scale (high attractiveness: α = .76; low attractiveness: α = .77) (see Table 1; for question-by-question analyses, see Appendix). Mean Target Sex Drive scores by Participant Relationship Status, Competition, and Target Attractiveness are presented in Table 3. These scores were entered into a 2 (Participant Relationship Status: mated vs. single) by 3 (Competition: winning vs. losing. vs. control) by 2 (Target Attractiveness: high attractiveness vs. low attractiveness) mixed-design ANOVA, with Participant Relationship Status and Competition being between-subjects factors and Target Attractiveness being a within-subjects factor.

The analysis produced a significant main effect of Target Attractiveness, $F(1, 90) = 28.81$, $p < .001$, $\eta_p = .4919$, such that participants gave high-attractiveness women higher Target Sex Drive ratings ($M = 4.21$, $SD = 1.58$) than they gave low-attractiveness women ($M = 3.11$, $SD = 1.82$). There were no significant main effects or interactions involving Competition or Participant Relationship Status.

Separate follow-up analyses were conducted on each of the two individual questions contained within the Target Sex Drive measure. For one Target Sex Drive question ("How sexually aroused is this woman?"), there was a marginally significant Target Attractiveness by Competition by Participant Relationship Status interaction, $F(2, 90) = 2.91$, $p = .06$, $\eta_p = .247$, which was in the predicted direction—but only in regard to single participants rating high-attractiveness women's sexual arousal [i.e., single participants who were in the winning condition tended to rate high-attractiveness women as being more sexually aroused ($M = 4.11$, $SD = 1.91$) than single participants in the control ($M = 3.74$, $SD = 1.42$) and losing ($M = 3.07$, $SD = 1.71$) conditions, respectively. The predicted effects were not obtained in regard to single participants' ratings of low-attractiveness women (winning condition: $M = 2.44$, $SD = 1.92$; losing condition: $M = 3.00$, $SD = 2.27$; control condition: $M = 3.17$, $SD = 1.87$) nor in regard to mated participants' ratings of either high-attractiveness women (winning condition: $M = 3.79$, $SD = 1.93$; losing condition: $M = 4.31$, $SD = 1.97$; control condition: $M = 3.74$, $SD = 1.42$) or low-attractiveness women (winning condition: $M = 2.86$, $SD = 1.41$; losing condition: $M = 2.69$, $SD = 2.14$; control condition: $M = 2.38$, $SD = 1.89$)]. For the other Target Sex Drive question ("How interested is this woman in having sex?"), single participants' attribution of sexual interest to high-attractiveness women did not differ

significantly between participants in the winning (M = 4.89, SD = 1.88), losing (M = 4.33, SD = 1.72), and control (M = 4.35, SD = 1.58) conditions: $F(2, 90) = 1.31$, $p = .28$, $\eta_p = .1673$, nor did any of the other interactions approach significance.

Participant Sex Drive

Participant Sex Drive was computed as the average of seven questions measuring participants' sexual interest in female targets on an 8-point Likert-type scale (high attractiveness: $\alpha = .94$; low attractiveness: $\alpha = .92$) (see Table 2; for question-by-question analyses, see Appendix). Mean Participant Sex Drive scores by Participant Relationship Status, Competition, and Target Attractiveness are presented in Table 4. These scores were entered into a 2 (Participant Relationship Status: mated vs. single) by 3 (Competition: winning vs. losing. vs. control) by 2 (Target Attractiveness: high attractiveness vs. low attractiveness) mixed-design ANOVA, with Participant Relationship Status and Competition being between-subjects factors and Target Attractiveness being a within-subjects factor.

The analysis produced a significant main effect of Target Attractiveness, $F(1, 88) = 273.06$, $p < .001$, $\eta_p = .8695$, such that high-attractiveness women were associated with higher Participant Sex Drive ratings (M = 4.27, SD = 1.71) than low attractiveness women (M = 1.40, SD = .83). There was also a significant Competition by Participant Relationship Status interaction, $F(2, 88) = 3.5$, $p = .035$, $\eta_p = .272$, such that the predicted effect of Competition was observed in the Participant Sex Drive ratings of single participants. Tukey HSD follow-up tests revealed that single participants in the winning condition showed significantly higher Participant Sex Drive ratings (M = 3.25,

SD = .72) than single participants in the losing condition (*M* = 2.25, *SD* = .81). Single participants in the control condition showed an intermediate Participant Sex Drive rating (*M* = 2.77, *SD* = .93) that did not differ significantly from the ratings of participants in either the winning or losing conditions. For mated participants, there were no significant differences between participants in the winning (*M* = 2.77, *SD* = .85), losing (*M* = 3.22, *SD* = 1.83), and control (*M* = 2.81, *SD* = 1.11) conditions [based on a one-way ANOVA with Competition as a between subjects factor: $F(2, 37) = .45$, $p = .64$, $\eta_p = .1581$].

Although the triple interaction was not significant, $F(2, 88) = 1.33$, $p = .27$, $\eta_p = .1703$, an examination of Figure 2 revealed that the Competition by Participant Relationship Status interaction was mostly driven by single participants' ratings of high-attractiveness women. Additional Tukey HSD follow-up tests revealed that single participants in the winning condition exhibited a significantly higher Participant Sex Drive ratings when evaluating high-attractiveness women (*M* = 5.06, *SD* = 1.23) than single participants in the losing condition (*M* = 3.33, *SD* = 1.57). Single participants in the control condition exhibited an intermediate Participant Sex Drive rating (*M* = 4.12, *SD* = 1.57) that did not differ significantly from the ratings of participants in either the winning or losing conditions. In contrast, there were no significant differences in ratings for single participants among the three competition groups when evaluating low-attractiveness women (winning condition: *M* = 1.44, *SD* = .53; losing condition: *M* = 1.16, *SD* = .21; control condition: *M* = 1.42, *SD* = .56). Although mated participants exhibited a main effect of Target Attractiveness on Participant Sex Drive [high-attractiveness women were given greater Participant Sex Drive scores (*M* = 4.35, *SD* = 1.88) than low-attractiveness women (*M* = 1.47, *SD* = 1.18)], mated participants showed

no significant differences across levels of Competition for their ratings of either high-attractiveness women (winning condition: M = 4.20, SD = 1.56; losing condition: M = 4.56, SD = 2.13; control condition: M = 4.34, SD = 2.11) or low-attractiveness women (winning condition: M = 1.33, SD = .47; losing condition: M = 1.88, SD = 2.05; control condition: M = 1.27, SD = .55).

Discussion

The hypothesized effect of competitive outcomes on men's sex-drive was supported by single men's "Participant Sex Drive" ratings, whereas competitive outcomes had no effect on the sex-drive of men in sexually-active relationships. Specifically, single men who were given winning feedback exhibited the highest average sex-drive score (as measured by their self-reported sexual interest), followed by men in the control and losing conditions, respectively. Furthermore, the effects were strongest for single men's ratings of high-attractiveness women. In support of error management theory, men were more likely to over-perceive sexual interest in high-attractiveness women than low-attractiveness women, suggesting a disposition aimed at seizing mating opportunities with fertile, genetically-healthy women. However, contrary to what was hypothesized, there were no significant effects of competitive outcomes on men's average attributions of sexual interest to women—though there was a marginal interaction in the predicted direction between competitive outcomes and relationship status on a question measuring men's attributions of arousal to high-attractiveness women, with single men in the winning condition attributing more sexual arousal to high-attractiveness women than single men in the control and losing conditions, respectively. The reason for this partial result may be due to the small number of questions (2) pertaining to men's attribution of sexual interest to women; future research should

incorporate more diverse measures of men's attribution of sexual interest to women as a function of differential competitive outcomes.

The differential effects of competitive outcomes on mated versus single men's sex-drives were not predicted. One proximate-level explanation is suggested by studies tracking the relative decreases in testosterone experienced by men in ever-increasing stages of romantic commitment, with marriage and (especially) fatherhood being associated with context-dependent reductions in testosterone and mate-seeking behavior (Gettler et al., 2011a; Gettler et al., 2011b; Gray et al., 2002; Gray et al., 2006; Kuzawa et al., 2009; McIntyre et al., 2006; Pollet et al., 2011; van Anders & Watson, 2006). It is possible that along with such absolute reductions in testosterone, men who are in relationships may undergo a decrease in testosterone-level sensitivity to context-dependent shifts in social status, as would normally occur upon a man's victory or defeat in a competition with another man. The ultimate, evolutionary explanation for such proximate-level differences in testosterone regulation may be the high cost of competitiveness and mate-seeking behavior. Specifically, men in relationships might weigh the relative tradeoffs of continued intrasexual competition and mate-seeking behavior differently than single men, such that, for men who are already mated, the reproductive benefits of sex-drive increases as a result of winning might not be worth the associated risks of losing one's time, resources, reputation, and, most importantly, one's current romantic partner, as well as experiencing the immunosuppressive effects of testosterone and the likelihood of physical injury and death as a result of continued competition and mate-seeking behavior. Conversely, losing should not be expected to decrease mated men's sex-drive because these men can continue to engage in sexual

activity with their romantic partners. At a proximate level, this may be accomplished by the protective effects of being in a relationship on men's self-esteem, positive self-concept, and/or self-perceived mate-value—factors that may contribute to the maintenance of mated men's sex-drive in the face of defeat. Of course, whether being in a relationship is associated with such a protective effect on men's sex-drive is an open, empirical question.

Although it is possible that social pressure or demand characteristics might have caused mated men in the winning condition to report less sexual interest than they actually experienced, this is unlikely, as all participants' (whether mated or single) reported greater sexual interest in high-attractiveness women than in low-attractiveness women, obviating the possibility that mated men in the winning condition wanted to save face by reporting less sexual interest in women who are not their partners. Demand characteristics may have still played a role, however, in single participants' responses, which were in the hypothesized direction. Although participants were questioned about what they thought the present study was about prior to debriefing, further research should seek to minimize the possibility of demand characteristics by striving to eliminate any cues that might direct participant responses.

The results of the present study support the predicted effects of competition on men's sex-drive—predictions that stem from the theoretical and empirical framework of the challenge hypothesis. However, because participants' testosterone was not measured in the present study, it is not known whether the observed differences in sex-drive were mediated by the differential effects of competition on participants' testosterone levels. It is possible, for example, that there might be a higher-level cortical association between

the experience of winning and sexual ideation, an association that bypasses the hypothalamic-pitutiary-gonadal circuit responsible for the regulation of testosterone and other sex hormones. Even if the testosterone circuit is involved, more work is needed to track the psychosocial processes that are associated with the physiological effects of testosterone and other hormones. In addition, it is possible that the current results might reflect the differential effect of competition on men's *mate preferences* as opposed to sex-drive. This possibility might explain why there were no *significant* effects of competitive outcomes on single participants' sexual interest in low attractiveness women; that is, if winning leads to an increase in testosterone, then we should expect a general increase in sex-drive irrespective of how attractive the target of that sex-drive is. However, because single men's responses to low-attractiveness women were in the predicted direction (that is, men in the winning condition reported more sexual interest, followed by men in the control and losing conditions, respectively; see Table 4), then the greater effects of competition on single men's sexual interest in high-attractiveness women may reflect a more discriminating canalization of participants' sex-drive— i.e., a testosterone-mediated rise in sex-drive might only—or mostly—be reflected in single men's responses to high-attractiveness rather than low-attractiveness women. Furthermore, it would make evolutionary sense if, in addition to experiencing a general increase in sex-drive, single winners would be more interested in pursuing high-attractiveness women—women who might be more interested in them now that their social status has increased.

Admitedly, it is still possible that changes in mate preferences—rather than sex-drive—may explain why the effects of competitive outcomes on single participants were

mostly confined to ratings of high-attractiveness women. Because there were no female targets of intermediate attractiveness, there might have been floor effects in men's ratings of sexual interest in low-attractiveness women—floor effects that might have hidden the effects of competitive outcomes on participants' mate preferences. For instance, rather than down-regulating their sex-drive, it is possible that men who experience a loss might become more interested in pursuing women of intermediate attractiveness. Another explanation, however, is that underlying changes is sex-drive may be responsible for the adaptive, context-dependent regulation of men's mate preferences, as discussed in the previous paragraph. It is necessary for subsequent investigations to differentiate the effect of competition on men's changes in sex-drive versus mate preferences and, in so doing, to arrive at an empirically cogent definition of each construct.

A potential limitation may be the biased nature of the sample. Although the exclusion of participants who either guessed the study's main hypothesis or the fabricated nature of the competitive task (14 participants) was based on participant responses to experimenters' probing questions prior to debriefing (and not to participants' responses on the questionnaire), the fact that the predicted effects disappeared when those participants were included in the sample suggests that caution must be used in generalizing to the male population from the current sample alone; this is in addition to the fact that the current sample was entirely composed of undergraduate men from a Western university setting.

Future Directions

Investigators might do well to examine whether a reversal of what was observed in the present study might also be a possiblity—that is, does cuing sex-related thinking

cause men to become more competitive, assuming that sex is one of the primary motivations for men's competitiveness? This possiblity is attested to by the fact that young, single men are dispraportionately the most likely to commit violent crimes and engage in warfare (Daly & Wilson, 1998). Thus, the relationship between men's competitiveness and sexual behavior is an important area of investigation not only because of the inherently interesting nature of the topic—a topic that traverses the deeply historical roots of our evolution as well as our current functionioning, whether in the boardroom or on the basketball court—but also because of its implications for predicting instances of rape, sexual coercion, and warfware. Indeed, it is during instances of war and genocide—contexts of extreme violent competition between groups of men—wherein some of the most destructive examples of sexual violence are on display (see Morris, 1996, Pinker, 2011, and Smith, 2007). Perhaps by acknowledging the biological connection between male competitiveness, perceptions of victory, and increases in sexual interest, we can adequately prepare for various context-dependent increases in rape and sexual coercion. For example, peacekeepers and policymakers might be able to anticipate increases in sexual violence in contexts of civil and international conflicts, and law enforcement officers might pay particular attention to the possiblity of male sexual aggression in the alcohol-fueled context of college and professional sports victories. It likewise remains an open question as to whether men may seek to undermine other men's sex-drives by sending fake, manipulative signals of their own victory or of their competitors' defeat.

Appendix

The following results are from a post-hoc analysis of Participant Relationship Status (mated/single), Competition (win/lose/control) , and Target Attractiveness (high/low) on both, individual questions related to sex-drive and other, non-sex-drive related questions (all questions were answered on an 8-point Likert-type scale; see the main text for a factor-analysis by question type). Due to the post-hoc nature of the examination, any main effects or interactions discussed for non-sex-drive questions should be interpreted tentatively. I used a 2x3x2 mixed design, repeated measures ANOVA, with Participant Relationship Status and Competition as between-subjects factors and Target Attractiveness as a within-subjects factor, which yielded the following main effects and interactions (*note*: questions are not discussed in the order in which they were presented to participants):

Non-Sex-Drive Questions

1. **How adventurous is this woman?** This question yielded a main effect of Target Attractiveness, F (1, 89) = 76.33, $p < .001$, $\eta_p = .6797$, such that high-attractiveness women were generally rated as being more adventurous (M = 5.47, SD = 1.39) than low-attractiveness women (M = 3.85, SD = 1.54), regardless of Participant Relationship Status or Competition prime. There were no other significant main effects or interactions.

2. **How artistic is this woman?** Although Target Attractiveness yielded a marginal main effect, such that low-attractiveness women were judged to be more artistic (M = 4.81, SD = 1.54) that high-attractiveness women (M = 4.45, SD = 1.44), it did not reach significance, F (1, 90) = 3.512, p = .06, η_p = .1949. There was, however, a significant Target Attractiveness by Competition by Participant Relationship Status interaction, F (2, 90) = 4.08, p = .02, η_p = .2881. It appears that mated men in both competition conditions judged low-attractiveness women as being more artistic (winning condition: M = 4.93, SE = .40; losing condition: M = 5.77, SE = .42) than high-attractiveness women (winning condition: M = 4.13, SE = .39; losing condition: M = 4.62, SE = .40), whereas there was no change between competing single men's judgments of how artistic they found low-attractiveness women (winning condition M = 4.56, SE = .36; losing condition: M = 4.73, SE = .39) and high-attractiveness women (winning condition: M = 4.56, SE = .34; losing condition: M = 4.73, SE = .38). On the other hand, whereas mated men in the control condition found high-attractiveness women to be more artistic (M = 4.62, SE = .40) than low-attractiveness women (M = 4.08, SE = .42), the effect was reversed in single men in the control condition (high-attractiveness targets: M = 4.17, SE = .30; low-attractiveness targets: M = 4.87, SE = .32).
3. **How courageous is this woman?** This question yielded a main effect of Target Attractiveness, F (1, 89) = 14.17, p < .001, η_p = .3701, such that high-

attractiveness women were generally rated as being more courageous (M = 4.75, SD = 1.45) than low-attractiveness women (M = 3.92, SD = 1.81), regardless of Participant Relationship Status or Competition prime. There were no other significant main effects or interactions.

4. **How happy is this woman?** This question yielded a main effect of Target Attractiveness, F (1, 88) = 4.05, p = .047, η_p = .2098, such that high-attractiveness women were generally rated as being more happy (M = 6.59, SD = 1.19) than low-attractiveness women (M = 6.23, SD = 1.85), regardless of Participant Relationship Status or Competition prime. Although not significant, there was a marginal main effect of competition, such that participants in the winning (M = 6.68; SE = .23) and losing (M = 6.55, SE = .23) conditions rated women as being more happy than participants in the control condition (M = 6.02, SE = .22): F (2, 88) = 2.48, p = .09, η_p = .2302. There were no other significant main effects or interactions.
5. **How hardworking is this woman?** This question yielded a main effect of Target Attractiveness, F (1, 89) = 7.25, p = .008, η_p = .2739, such that low-attractiveness women were judged to be more hardworking (M = 5.47, SD = 1.54) than high-attractiveness women (M = 5.05, SD = 1.39). There was also a non-significant main effect of Competition, F (2, 89) = 2.52, p = .09, η_p = .2324, such that men in the losing condition judged women to be more hardworking (M = 5.61, SE = .23) than men in the winning (M = 5.37, SE = .22) and control (M = 4.92, SE = .21) conditions, respectively.

6. **How intelligent is this woman?** This question yielded no significant main effects or interactions.
7. **How strict is this woman?** This question yielded no significant main effects or interactions.

Sex-Drive Questions

Target sex-drive questions.

1. ***How sexually aroused is this woman?*** This question yielded a significant main effect of Target Attractiveness, F (1, 90) = 26.65, p < .001, η_p = .4775, such that high-attractiveness women were generally rated as being more sexually aroused (M = 3.89, SD = 1.75) than low-attractiveness women (M = 2.79, SD = 1.90). There was a non-significant Target Attractiveness by Participant Relationship interaction, F (1, 90) = 3.00, p = .09, η_p = .1789, such that mated men judged high-attractiveness women as being more aroused (M = 4.19, SE = 2.8) than low-attractiveness women (M = 2.65, SD = .31) to a greater extent than single men judged high-attractiveness women to be more aroused (M = 3.64, SD = .24) than low-attractiveness women (M = 2.87, SD = .26). There was also a non-significant Target Attractiveness by Competition by Participant Relationship Status interaction in the partly-predicted direction, but only for single participants rating high-attractiveness women—that is, single participants who were in the winning condition tended to rate high-attractiveness women as being the most sexually aroused (M = 4.11,

SD = 1.91), followed by single participants in the control (*M* = 3.74, *SD* = 1.42) and losing (*M* = 3.07, *SD* = 1.71) conditions, respectively: *F* (2, 90) = 2.91, *p* = .06, η_p = .247.

2. ***How interested is this woman in having sex?*** This question yielded a significant main effect of Target Attractiveness, *F* (1, 90) = 20.01, *p* < .001, η_p = .4266, such that high-attractiveness women were generally rated as being more interested in having sex (*M* = 4.54, *SD* = 1.77) than low-attractiveness women (*M* = 3.43, *SD* = 2.14), regardless of Participant Relationship Status or Competition prime. There were no other significant main effects or interactions.

Participant sex-drive questions.

3. ***How attractive is this woman?*** This question yielded a main effect of Target Attractiveness, *F* (1, 90) = 439.17, *p* < .001, η_p = .911, such that high-attractiveness women were generally rated as being more attractive (*M* = 5.28, *SD* = 1.61) than low-attractiveness women (*M* = 1.79, *SD* = 1.11). There was a significant Target Attractiveness by Competition interaction, *F* (2, 90) = 4.72, *p* = .01, η_p = .3082, such that men in the winning and control conditions rated high-attractiveness women as being more attractive than men in the losing condition (winning: *M* = 5.72, *SE* = .28; control: *M* = 5.20, *SE* = .27; losing: *M* = 4.94, *SE* = .30), whereas men in the winning and control conditions rated low-attractiveness women as being less attractive than

men in the losing condition (winning: *M* = 1.60, *SE* = .19; control: *M* = 1.67, *SE* = .19; losing: *M* = 2.11, *S.E* = .21). Furthermore, there was a Competition by Participant Relationship Status interaction, *F* (2, 90) = 3.12, *p* = .049, η_p = .255, such that mated men rated women as being more attractive when they were in the losing condition (*M* = 3.89, *SE* = .30) than when they were in the control (*M* = 3.5, *SE* = .30) and winning (*M* = 3.32, *SE* = .29) conditions, respectively, whereas single men rated women as being more attractive when they were in the winning condition (*M* = 4.00, *SE* = .26) than when they were in the control (*M* = 3.37, *SE* = .23) and losing conditions (*M* = 3.17, *SE* = .28), respectively. Finally, there was a marginal Target Attractiveness by Competition by Participant Relationship Status interaction, *F* (2, 90) = 3.03, *p* = .054, η_p = .251, which was in the predicted direction for single participants rating high-attractiveness women's attractiveness (winning condition: *M* = 6.22, *SD* = 1.06; control condition: *M* = 4.87, *SD* = 1.69; losing condition: *M* = 4.73, *SD* = 1.75).

4. ***How likely are you to approach this woman in a bar?*** This question yielded a main effect of Target Attractiveness, *F* (1, 89) = 187.52, *p* < .001, η_p = .8234, such that high-attractiveness women were generally rated as being more likely to be approached in a bar (*M* = 4.35, *SD* = 2.05) than low-attractiveness women (*M* = 1.47, *SD* = 1.13),

regardless of Participant Relationship Status or Competition prime. Although there were no other significant main effects or interactions, the differences between participants in the winning, losing, and control conditions followed the predicted pattern—that is, participants in the winning condition were more likely to report wanting to approach a woman in a bar (M = 3.12, SE = .24), followed by participants in the control (M = 2.89, SE = .23) and losing conditions (M = 2.74, SE = .26), respectively (this trend was especially pronounced in single participants' ratings of their likelihood to approach high-attractiveness women—winning condition: M = 4.78, SD = 1.70; control condition: M = 4.35, SD = 1.92; losing condition: M = 3.40, SD = 2.23).

5. ***How likely are you to ask this woman out on a date?*** This question yielded a significant main effect of Target Attractiveness, F (1, 89) = 188.74, $p < .001$, η_p = .8246, such that high-attractiveness women were generally rated as being more likely to be asked out on a date (M = 4.05, SD = 1.96) than low-attractiveness women (M = 1.29, SD = .89), regardless of Participant Relationship Status or Competition prime. Although there were no other significant main effects or interactions, the differences between participants in the winning (M = 2.89, SE = .21), control (M = 2.65, SE = .20), and losing conditions (M = 2.42, SE = .23) followed the predicted pattern, which was especially prominent in single men's desire to ask high-attractiveness women out on a date (winning condition: M = 5.00, SD = 1.75;

control condition: *M* = 4.04, *SD* = 1.58; losing condition: *M* = 3.27, *SD* = 1.98).

6. ***How interested are you in going on a date with this woman?*** This question yielded a significant main effect of Target Attractiveness, *F* (1, 90) = 194.18, $p < .001$, $\eta_p = .8264$, such that participants were more interested in going on a date with high-attractiveness women (*M* = 4.15, *SD* = 2.06) than low-attractiveness women (*M* = 1.26, *SD* = .84), regardless of Participant Relationship Status or Competition prime. There was also a non-significant interaction between Competition and Participant Relationship Status, *F* (2, 90) = 2.83, $p = .06$, $\eta_p = .2429$, such that only single participants showed the predicted effect of competition on their interest in going on a date with the photographed women (winning condition: *M* = 3.36, *SE* = .28; control condition: *M* = 2.61, *SE* = .25; losing condition: *M* = 2.27, *SE* = .31). Mated participants, on the other hand, were more interested in going on a date when they were in the losing condition (*M* = 2.93, *SE* = .33), as opposed to the winning condition (*M* = 2.54, *SE* = .32) and control condition (*M* = 2.42, *SE* = .33), respectively. The predicted trend is especially noticeable in single men's interest in going on a date with high-attractiveness women, such that single men in the winning condition were more interested in going on a date with high-attractiveness women (*M* = 5.28, *SD* = 1.53) than single men in the

control (M = 3.96, SD = 1.72) and losing conditions (M = 3.47, SD = 2.00), respectively.

7. ***How interested are you in developing a relationship with this woman?*** This question yielded a significant main effect of Target Attractiveness, F (1, 90) = 135.33, $p < .001$, η_p = .7752, such that participants were more interested in developing a relationship with high-attractiveness women (M = 3.63, SD = 2.00) than low-attractiveness women (M = 1.36, SD = .93), regardless of Participant Relationship Status or Competition prime. There were no other significant main effects or interactions, although single men's interest in developing a relationship with high-attractiveness women was in the predicted direction (winning condition: M = 4.61, SD = 1.46; control condition: M = 3.57, SD = 1.85; losing condition: M = 3.00, SD = 1.96)

8. ***How interested are you in having sex with this woman?*** This question yielded a significant main effect of Target Attractiveness, F (1, 90) = 192.42, $p < .001$, η_p = .8252, such that participants were more interested in having sex with high-attractiveness women (M = 4.53, SD = 2.25) than low-attractiveness women (M = 1.34, SD = 1.10), regardless of Participant Relationship Status or Competition prime. There were no other significant main effects or interactions, although single men's interest in having sex with high-attractiveness women was in the predicted direction (winning condition: M = 5.06, SD =

1.98; control condition: *M* = 4.48, *SD* = 1.83; losing condition: *M* = 3.07, *SD* = 1.71).

9. ***How sexually "turned on" are you by this woman?*** This question yielded a significant main effect of Target Attractiveness, *F* (1, 90) = 186.12, $p < .001$, $\eta_p = .821$, such that participants rated themselves as being more turned on by high-attractiveness women (*M* = 3.74, *SD* = 1.91) than low-attractiveness women (*M* = 1.26, *SD* = 1.05). There was also a significant Target Attractiveness by Competition interaction, *F* (2, 90) = 3.71, $p = .03$, $\eta_p = .2757$, such that men in the winning condition reported being more turned on by *high-attractiveness* women (*M* = 4.22, *SE* = .33) than men in the control (*M* = 3.88, *SE* = .32) and losing (*M* = 3.12, *SE* = .35) conditions, respectively. Conversely, men in the control condition reported being more turned on by *low-attractiveness* women (*M* = 1.36, *SE* = .18) than men in the losing (*M* = 1.31, *SE* = .20) and winning conditions (*M* = 1.18, *SE* = .19), respectively. The predicted trend was especially evident in single men's ratings of being turned on by high-attractiveness women (winning condition: *M* = 4.44, *SD* = 1.79; control condition: *M* = 3.61, *SD* = 1.67; losing condition: *M* = 2.40, *SD* = 1.18).

Table 1

Target Sex Drive Questionnaire (rated on an 8-point scale)

Question
How interested is this woman in having sex?
How sexually aroused is this woman?

Table 2

Participant Sex Drive Questionnaire (rated on an 8-point scale)

Question
How attractive is this woman?
How likely are you to ask this woman out on a date?
How likely are you to approach this woman in a bar?
How interested are you in going on a date with this woman?
How interested are you in developing a relationship with this woman?
How interested are you in having sex with this woman?
How sexually turned-on are you by this woman?

Table 3

Means and Standard Deviations for Target Sex Drive by Relationship Status, Competition Condition, and Target Attractiveness

		Condition			Marginal Means	
		Winning	Losing	Control		
Total Mated Participants: *M* = 3.65	HA Targets	*M* = 4.18 *SD* = 1.67	*M* = 4.19 *SD* = 1.81	*M* = 4.77 *SD* = 1.60	*M* = 4.38	Total HA Targets: *M* = 4.21
	LA Targets	*M* = 3.04 *SD* =1.61	*M* = 2.96 *SD* = 2.30	*M* = 2.77 *SD* = 1.79	*M* = 2.93	
Total Single Participants: *M* = 3.66	HA Targets	*M* = 4.50 *SD* = 1.77	*M* = 3.70 *SD* = 1.35	*M* = 4.04 *SD* = 1.38	*M* = 4.10	Total LA Targets: *M* = 3.11
	LA Targets	*M* = 2.69 *SD* = 1.83	*M* = 3.50 *SD* = 2.04	*M* = 3.50 *SD* = 1.56	*M* = 3.24	
Marginal Means		*M* = 3.60	*M* = 3.59	*M* = 3.77		

HA = High Attractiveness
LA = Low Attractiveness

Table 4

Means and Standard Deviations for Participant Sex Drive by Relationship Status, Competition Condition, and Target Attractiveness

		Condition			Marginal Means	
		Winning	Losing	Control		
Total Mated Participants: *M* = 2.93	HA Targets	*M* = 4.20 *SD* = 1.56	*M* = 4.56 *SD* = 2.13	*M* = 4.34 *SD* = 2.11	*M* = 4.35	Total HA Targets: *M* = 4.27
	LA Targets	*M* = 1.33 *SD* =.47	*M* = 1.88 *SD* = 2.05	*M* = 1.27 *SD* = .55	*M* = 1.47	
Total Single Participants: *M* = 2.76	HA Targets	*M* = 5.06 *SD* = 1.23	*M* = 3.33 *SD* = 1.57	*M* = 4.12 *SD* = 1.57	*M* = 4.21	Total LA Targets: *M* = 1.40
	LA Targets	*M* = 1.44 *SD* = .53	*M* = 1.16 *SD* = .21	*M* = 1.42 *SD* = .56	*M* = 1.36	
Marginal Means		*M* = 3.01	*M* = 2.73	*M* = 2.79		

HA = High Attractiveness
LA = Low Attractiveness

Table 5

Demographics Questionnaire

1. Participant age: _____
2. Are you currently in a sexually-active relationship?
Yes____ No____
3. Do you consider yourself to be:
a. American Indian or Alaskan Native;
b. Asian;
c. Black or African American;
d. Hawaiian or Pacific Islander; or
e. White?
4. Do you consider yourself to be:
a. Heterosexual or straight;
b. Gay or homosexual; or
c. Bisexual?
5. What is your estimated household income?
a. Less than $10,000
b. $10,000 to $19,999
c. $20,000 to $29,999
d. $30,000 to $39,999
e. $40,000 to $49,999
f. $50,000 to $59,999
g. $60,000 to $69,999
h. $70,000 to $79,999
i. $80,000 to $89,000
j. $90,000 to $99,999
k. $100,000 to $150,000
l. More than $150,000
6. What is your parents' estimated household income?
a. Less than $10,000
b. $10,000 to $19,999
c. $20,000 to $29,999
d. $30,000 to $39,999
e. $40,000 to $49,999
f. $50,000 to $59,999
g. $60,000 to $69,999
h. $70,000 to $79,999
i. $80,000 to $89,000
j. $90,000 to $99,999
k. $100,000 to $150,000
l. More than $150,000

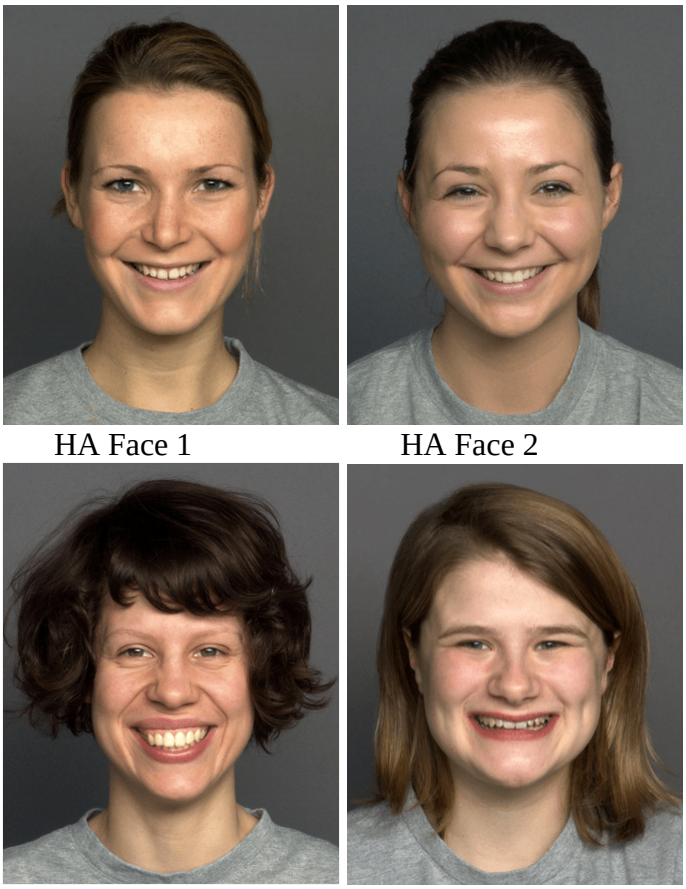

Figure 1. Photographs used to gauge participants' sex drive, separated by high attractiveness (HA) and low attractiveness (LA). Faces were obtained from the FACES database, compiled by Ebner, Riediger, and Lindenberger (2010).

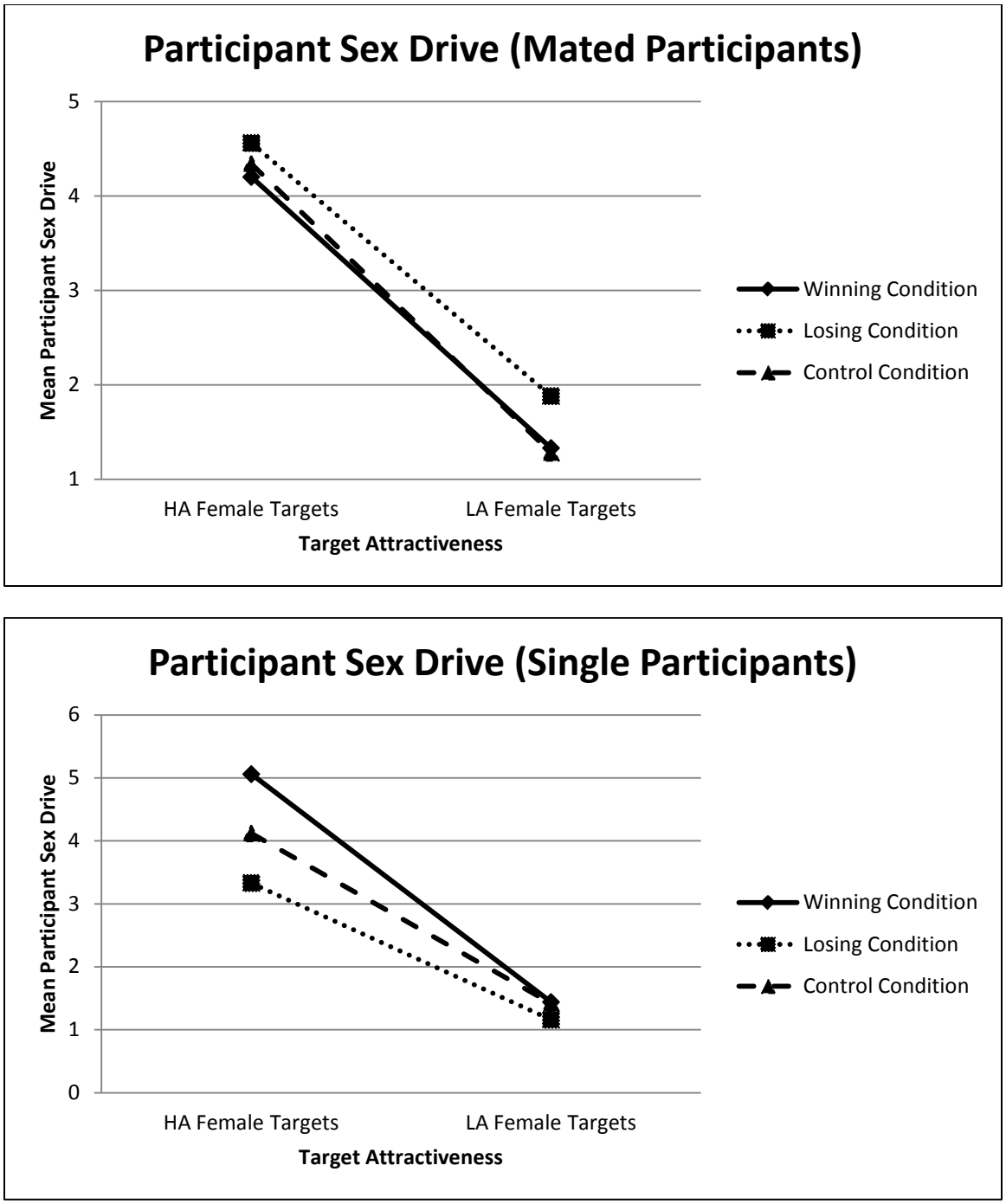

Figure 2. Mean Participant Sex Drive Ratings (on an 8-point Likert-type scale) for Mated Participants (top) and Single Participants (bottom), separated by target attractiveness (i.e., HA: high attractiveness; LA: low attractiveness).

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