The Financial Consequences of Too Many Men: Sex Ratio Effects on Saving, Borrowing, and Spending

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The ratio of males to females in a population is an important factor in determining behavior in animals. We propose that sex ratio also has pervasive effects in humans, such as by influencing economic decisions. Using both historical data and experiments, we examined how sex ratio influences saving, borrowing, and spending in the United States. Findings show that male-biased sex ratios (an abundance of men) lead men to discount the future and desire immediate rewards. Male-biased sex ratios decreased men's desire to save for the future and increased their willingness to incur debt for immediate expenditures. Sex ratio appears to influence behavior by increasing the intensity of same-sex competition for mates. Accordingly, a scarcity of women led people to expect men to spend more money during courtship, such as by paying more for engagement rings. These findings demonstrate experimentally that sex ratio influences human decision making in ways consistent with evolutionary biological theory. Implications for sex ratio effects across cultures are discussed.

Keywords: sex ratio, mating, competition, consumer behavior, financial decisions

Macon, Georgia, and Columbus, Georgia, are two cities in the southeastern United States that are less than a hundred miles apart. Both cities share a similar historical heritage and economic climate. Despite these similarities, the residents of each city have drastically different spending habits: The average consumer debt of people living in Columbus is an astounding 2.7 standard deviations higher than that of people living in Macon—a difference of $3,479 per consumer (Experian Information Solutions, 2010). What might account for this staggering divergence in spending across the two nearby cities?

We suggest that this difference in debt might be linked to an often overlooked difference between the two cities: the ratio of single adult men to women in each area. Whereas in Macon there are only 0.78 single men for every woman, in Columbus there are 1.18 single men for every woman (American Community Survey, 2009).

The ratio of men to women can vary substantially from region to region. In the United States, for example, cities such as Denver, Colorado, and Las Vegas, Nevada, have decidedly more men. Other cities—such as Birmingham, Alabama, and Peoria, Illinois—have more women. Variation in sex ratios is not simply of demographic interest. Past research has suggested that local sex ratios influence patterns of mating behavior and family life (see e.g., Guttentag & Secord, 1983; Hesketh & Zhu, 2006; Pollet & Nettle, 2008). There are reasons to believe, however, that sex ratio has an even broader impact, affecting many other areas of human life. We propose here that sex ratio may influence economic behavior and the psychology of financial decision making. Sex ratio is likely to influence consumer behavior by affecting the intensity of same-sex competition for mates. For example, the economic impulsivity in a city like Columbus, Georgia, may be related to the abundance of men competing for women in that city. We use both archival data and some of the first experimental

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manipulations of perceived sex ratio to investigate how sex ratio influences financial decisions.

The Evolutionary Biology of Sex Ratios

The study of how the ratio of men to women in a population influences behavior originates in evolutionary approaches to animal behavior (Fisher, 1930; James, 1987). Theory and research in this area focuses on the ratio of reproductive-age males and females, which is known as the *operational sex ratio* (Emlen & Oring, 1977; Fossett & Kiecolt, 1991). Operational sex ratio influences both the availability of potential mates and the intensity of competition for those mates, thereby affecting many types of behavior by changing mating dynamics (Taylor & Bulmer, 1980; Weir, Grant, & Hutchings, 2011).

Sex ratio tends to have small effects in species with a strong reproductive skew. This means that the ratio of males to females has little effect in "winner take all" mating systems in which only a few males mate with all available females (e.g., highly polygynous species). Instead, sex ratio has the strongest effects in mating systems that do not have a strong skew in mating success (Emlen & Oring, 1977). In socially monogamous mating systems, for example, a female-biased sex ratio (an abundance of females) can greatly increase a male's likelihood of attracting a mate. However, a male-biased sex ratio (an abundance of males) can similarly decrease a male's potential for reproductive success.

In most mammals, male reproductive success is more strongly affected than female reproductive success by the availability of mates (Trivers, 1972). Hence, the potential effects of an unbalanced sex ratio are expected to be more prominent in males than females. Male-biased sex ratios are especially likely to increase intrasexual competition in males because males are at an increased risk of failing to attract a mate when there is a scarcity of females (Balshine-Earn, 1996; Kvarnemo & Forsgren, 2000). Conversely, when sex ratio is female-biased and females are plentiful, males are under less pressure to outcompete rivals for potential mates.

Consistent with theory in evolutionary biology, animal research shows that operational sex ratio affects the level of intrasexual competition and male mating effort (Kvarnemo & Anhesjo, 1996). For example, when sex ratio shifts from female-biased to male-biased, male European bitterlings intensify intrasexual competition (Mills & Reynolds, 2003). Similarly, male-biased sex ratios lead male grey mouse lemurs to allocate more effort toward mate search (Eberle & Kappeler, 2004) and lead two-spotted goby males to increase mate competition (Forsgren, Amundsen, Borg, & Bjelvenmark, 2004). Overall, animal findings show that a scarcity of females leads males to allocate more energy and resources toward intrasexual competition for mates.

Sex Ratio and Human Behavior

Considering that many human societies have relatively low reproductive skew (i.e., few cultures have a winner-take-all mating system), sex ratio should have a considerable effect on human behavior. Indeed, correlational research examining general trends within populations shows that operational sex ratio is related to human mating and parenting patterns (see e.g., Barber, 2001; James, 1987; Kruger, 2009; Lichter, Kephart, McLaughlin, & Landry, 1992; Pollet & Nettle, 2008; Schmitt, 2005; Stone, Shackelford, & Buss, 2007).

The majority of research on humans has focused on how sex ratio relates to marriage and family outcomes, with findings supporting predictions from evolutionary biology, evolutionary psychology, and mating economics (Baumeister & Vohs, 2004; Buss & Schmitt, 1993; Gangestad & Simpson, 2000; Pedersen, 1991). Female-biased sex ratios (an abundance of women) are historically associated with lower marriage rates, more out-of-wedlock births, and lower paternal investment (Guttentag & Secord, 1983; South & Trent, 1988). Conversely, male-biased sex ratios (an abundance of men) are associated with the reverse pattern: higher marriage rates, fewer out-of-wedlock births, and higher paternal investment. These patterns suggest that changes in sex ratio change the behavior of the majority sex to match the typical preferences of the minority sex. For example, an abundance of women may require a woman who desires a mate to be less selective in her choice of romantic partners (Kenrick, Li, & Butner, 2003).

Sex ratio in humans is also associated with intrasexual competition. The relationship between sex ratio and competition in humans parallels findings in the animal literature. As human populations become more male-biased, for example, men's aggression and violence increase (Barber, 2003; Drèze & Keher, 2000; Hudson & Den Boer, 2002). Because men's intrasexual aggression is often directly linked to mating competition (Griskevicius, Tybur, et al., 2009; Wilson & Daly, 1985), these findings suggest that men may amplify mating effort when women are scarce. Thus, just as male-biased sex ratios lead males to increase mating effort in other animals, an overabundance of men appears to similarly lead men to allocate more resources toward mating effort.

Sex Ratio and Economic Behavior

Given that sex ratio consistently influences mating and competition behavior in animals, the relevance of sex ratio for human mating, parenting, and aggression is clear. But there are reasons to believe that sex ratio has an even broader impact. We hypothesize that sex ratio is likely to affect many important areas of human life such as consumer behavior and economic decisions. Recent research has shown that monetary decisions and consumer spending are related to mating effort (Griskevicius et al., 2007). Increased mating effort is associated with increased male desire for immediate financial rewards (Wilson & Daly, 2004) and increased male spending on conspicuous consumption products (Sundie et al., 2011). For example, men become more economically impulsive after merely touching a woman's brassiere (Van den Bergh, Dewitte, & Warlop, 2008).

Given that a male-biased sex ratio increases the degree to which men must compete for mates, and given the importance for men of advertising financial resources via spending and consumption, we predicted that shifts in sex ratio would be associated with men's desire for immediate gains. We should therefore see greater male economic impulsivity, both in real-world consumer behavior and in the laboratory, when the sex ratio is tipped toward men.

Study 1: Sex Ratio, Credit Cards, and Debt Across the United States

To begin examining the link between sex ratio and desire for immediate gains, we conducted a correlational study using real-

world data on sex ratio and economic behavior. We first obtained data that enabled us to calculate operational sex ratios in over 120 U.S. cities. We then obtained data for those same cities for two behavioral measures of economic impulsivity: (a) average number of credit cards owned by residents in each city and (b) average amount of debt carried by people in each city. Both of these behaviors are indicative of overspending and impulsivity (Norvilitis et al., 2006). We then examined how sex ratio was related to both measures. Because male-biased sex ratios are associated with increased male investment in mating effort, and because mating effort is associated with impulsivity, we predicted that male-biased sex ratios would be positively related to both measures of desire for immediate rewards.

Method

Sex ratio. On the basis of previous methods (Kruger, 2009), we calculated operational sex ratio as the ratio of adult unmarried men to unmarried women within a population. We calculated operational sex ratio for all available U.S. cities (American Community Survey, 2009), yielding sex ratio information for over 120 cities. The range in operational sex ratio was 0.78 to 1.63, with higher values indicating more single men for each single woman.

Economic indices. Because we are interested in how sex ratio is related to the desire for access to immediate gains, we obtained two types of relevant and available data: (a) the number of credit cards owned and (b) the amount of consumer debt held by people living in cities across the United States (Experian Information Solutions, 2010). Combining the operational sex ratio data with the financial data gave us a total sample of 134 cities for which both types of data were available, representing all major regions of the United States.

Results and Discussion

We examined zero-order correlations between sex ratio in the cities and the two different measures of economic impulsivity. Results revealed a positive correlation between sex ratio and number of credit cards, $r(134) = .24$, $p = .005$. There was a similar positive correlation between sex ratio and amount of debt, $r(134) = .19$, $p = .025$. A relative abundance of single men in America was related to both owning more credit cards and having a higher amount of debt.

The findings support our prediction regarding sex ratio and economic impulsivity. As operational sex ratio increases (i.e., the ratio goes from female-biased to male-biased), desire for immediate gains increases. Although we contend that sex ratio should specifically influence men's desire for immediate rewards, the correlational nature of the first study has limitations. For instance, sex-specific data are not available for these kinds of aggregate measures, making it impossible to determine whether the relationship between sex ratio and desire for immediate access to rewards is driven by men, women, or perhaps both genders. Furthermore, it is not possible to ascertain whether sex ratio has a causal effect with a correlational design.

Study 2: Manipulated Sex Ratio and Temporal Discounting

In Study 2 we experimentally manipulated perceived local sex ratio. Participants viewed photo arrays that were ostensibly indicative of the local population. The arrays were one of three types: male-skewed, female-skewed, or consisting of neutral control photos. We then examined how sex ratio influenced desire for immediate rewards.

As discussed earlier, male-biased sex ratios are associated with increased male intrasexual competition and mating effort in both humans and animals (see e.g., Barber, 2003; Drèze & Keher, 2000; Kvarnemo & Anhesjo, 1996; Taylor & Bulmer, 1980). We hypothesize that, consistent with the correlational findings from Study 1, male-biased sex ratios will lead to increased male desire for immediate rewards. An abundance of rivals should lead men to value immediate rewards because there is an important trade-off between acquiring immediate resources and waiting in hopes of acquiring more or better quality resources in the future. Consider, for example, a person who finds a fruit tree with fruit that are still a few days from being ripe. This person could choose to pick the available fruit now, or he could choose to come back later when the fruit is ripe. Although delaying gratification and forgoing immediate rewards can be adaptive under certain conditions (see Griskevicius, Tybur, Delton, & Robertson, 2011), an evolutionary perspective highlights an important drawback of delaying: If a man forgoes picking the fruit immediately, there is no guarantee that any fruit will be left in the future or that he will be around to collect them even if there are. Furthermore, increased competition for limited resources, such as when there is an abundance of rivals, further decreases the likelihood that any fruit will remain available in the future.

The fruit tree example provides insight into reasons why a male-biased sex ratio ecology should lead men to prioritize immediate rewards. In ecologies with higher male–male competition, male life spans tend to be shorter (Daly & Wilson, 1988). Because men are less likely to reach the future in such ecologies, the future becomes less valuable (Daly & Wilson, 2005). This in turn selects for organisms that prioritize benefits available now at the expense of benefits available in the uncertain future (Williams, 1957). A scarcity of women also means that an average man who delays mating effort is at risk of being shut out from mating because potential mates are continually being removed from the market. Thus, as sex ratio becomes male-biased and women become scarce, we predict that men should want immediate rewards.

Although predictions of how sex ratio should influence men's desire for immediate access to financial resources are clear, predictions for women are less clear. Men more so than women compete for mates through displays and offerings that have monetary value (Buss, 1989; Griskevicius et al., 2007; Miller, 2009). Income is also a much stronger predictor of a man's romantic desirability than a woman's (Li, Bailey, Kenrick, & Linsenmeier, 2002). Thus, it is unclear whether sex ratio should have any impact on women's desire for immediate access to monetary resources.

Method

Participants. In this study, 205 individuals (104 female) from a mixed student/community member sample participated. Mean participant age was 21.5 years ($SD = 2.9$), and the range was 18–36. Participants were compensated $10 and earned additional payment on the basis of their specific choices. For example, a participant who chose to receive $35 tomorrow rather than $45 in 33 days could be selected to receive $35 the following day. This type of incentive is common in behavioral economics experiments, and it increases the behavioral validity of the task.

Design and procedure. A 2 × 3 design with participant sex and sex ratio (female-biased, neutral control, male-biased) as between-subjects factors was used. On individual computers, participants first viewed a series of photo arrays that varied on sex ratio or viewed neutral control photos. Then participants made a series of 20 financial choices that allowed assessment of their temporal discounting rates.

To minimize suspicion, we told participants that the session consisted of several different studies, the first of which concerned accuracy in interpersonal perception. Consistent with this story, participants were asked to count the numbers of men and women in a series of photo arrays. After this task, participants began a study regarding financial preferences. Poststudy interviews revealed no suspicion or knowledge of the hypotheses.

Sex ratio manipulation. In the neutral control condition, participants viewed a series of nature images (e.g., fields, meadows). In the two sex ratio conditions, participants viewed a series of images of people. Specifically, participants saw three arrays of 18 photos each. The photos were obtained from public domain websites and contained a headshot of either a man or woman between the ages of 18 and 30. Participants were told that the first set of photos consisted of individuals between 18 and 30 from a local dating website, the second set was of recent graduates of the local university who were still living in the area, and the third set was taken on the university campus. Pilot testing indicated that photos were of comparable attractiveness (i.e., men and women were rated as similarly attractive).

In the female-biased condition, 13, 12, and 14 of the 18 faces in each of the three arrays were female; in the male-biased condition, 13, 12, and 14 of the faces were male. Consistent with the cover story, participants initially saw each array for 1 s and were asked to write how many men and women appeared in each array. Participants then viewed the same arrays again for 15 s each, ostensibly so that participants could check the accuracy of their initial perceptions. After this second viewing, participants again recorded the number of men and women, which served as a check of the sex ratio manipulation (94% of participants were accurate in their count after the 15-s viewing period, and the other 6% were off by only one or two people).

Temporal discounting measures. To assess temporal discounting, we used a method adapted from previous research (Green & Myerson, 2004; Wilson & Daly, 2004). Consistent with previous research, participants were first told that "one person from today's session will be chosen at random to receive the actual amount of money he or she chooses for one of the choices. So, make each choice knowing that you have a chance to receive the amount of money you choose as specified for each decision." Each day, a random participant was chosen to receive payment for a randomly chosen choice he or she had made.

Participants then made a series of 20 choices, choosing between receiving a specified amount of money tomorrow and receiving a larger amount of money 33 days from now. We developed the choices so that each item corresponded to a prespecified discounting parameter k, with greater k values meaning stronger future discounting. This k ranged from 0.0005 ($64 tomorrow vs. $65 in 33 days) to 0.2 ($9 tomorrow vs. $60 in 33 days). To determine the k associated with each decision, we used a standard discounting equation (see e.g., Green & Myerson, 2004) whereby the discounted value = actual value/[1 + (k × delay)]. Items were presented in random order (see Appendix for all 20 items).

Two conceptually similar dependent measures were computed from participants' choices. First, responses were combined into a discounting *index* computed by counting the total number of immediate rewards that were chosen. Larger values on the discounting index indicate a preference for immediate financial rewards.

Second, a discounting *parameter k* was also calculated for each individual. We used established techniques (Kirby & Marakovic, 1996) to estimate participants' discounting parameters. The estimation procedure hones in on the "switch point" at which participants stop choosing the amount available tomorrow and start choosing the amount available in 33 days. Although participants saw the discounting items in a random order, for purposes of the analyses the items were reordered in ascending k values. For instance, a participant may prefer $49 tomorrow over $57 in 33 days ($k$ = .005), reflecting a choice of an early reward, and prefer $86 in 33 days over $72 tomorrow ($k$ = .006), reflecting a change to choosing a later reward. To estimate this participant's k, the two k values that bound their switch point are averaged together. Our method follows that of Kirby & Marakovic (1996), which allows for occasional inconsistencies (e.g., preferring the earlier, then the later, then the earlier reward in succession). The final temporal discounting parameters are then log-transformed to correct for skew.

Results and Discussion

For the discounting index, an omnibus analysis of variance (ANOVA) revealed a marginally significant Sex Ratio × Participant Sex interaction, $F(2, 199) = 2.81$, $p = .063$ (see Figure 1). We probed this interaction by testing for sex ratio effects within male and female participants. For women, sex ratio had no effect on temporal discounting ($M_{\text{male-biased}} = 7.96$, $SE = 0.84$; $M_{\text{control}} = 7.33$, $SE = 0.75$; $M_{\text{female-biased}} = 8.37$, $SE = 0.73$; $p = .58$). For men, however, sex ratio did have a significant effect on temporal discounting ($M_{\text{male-biased}} = 10.35$, $SE = 0.68$; $M_{\text{control}} = 7.76$, $SE = 0.62$; $M_{\text{female-biased}} = 7.13$, $SE = 0.75$; $p = .002$). As predicted, and depicted in Figure 1, a male-biased sex ratio led men to discount the future relative to the female-biased sex ratio condition, $t(199) = 3.26$, $p = .001$, $d = 0.46$, and the

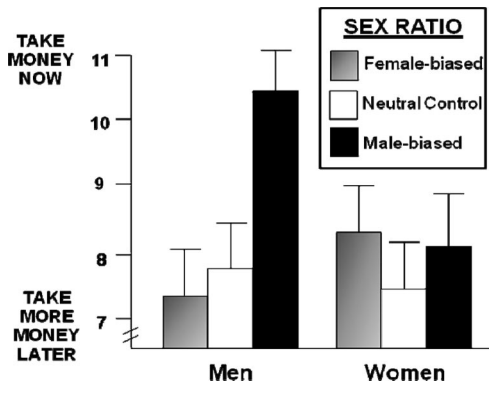

Figure 1. The number of times men and women chose to take money now rather than wait for more money later as a function of sex ratio in Study 2. Bars indicate standard errors.

neutral control condition, $t(199) = 2.66$, $p = .008$, $d = 0.38$. There was no difference between the neutral control condition and the female-biased sex ratio condition for men or for women. In summary, the study found that a male-biased sex ratio led men to opt for more immediate rewards.

Results for the discounting parameter were highly similar to those found using the index measure. As expected, there was no effect of sex ratio on discounting parameters for women ($p = .44$). Sex ratio did, however, affect men's discounting parameters ($p = .005$). Men's discounting parameters were greater in the male-biased sex ratio condition compared with both the female-biased condition, $t(199) = 2.98$, $p = .003$, $d = 0.42$, and the neutral control condition, $t(199) = 2.04$, $p = .043$, $d = 0.29$. Thus, consistent with the findings for the discounting index, analysis of men's discounting parameters revealed that men discounted the future more strongly after exposure to a male-biased sex ratio.

For descriptive purposes, we used the discounting parameters to calculate the number of days of delay required for a nominal amount of $100 to lose half its value. The faster the $100 loses value, the more strongly the future is discounted. For women, a female-biased and male-biased sex ratio led $100 to lose half its value in 104 and 112 days, respectively. For men, whereas a female-biased ratio led $100 to lose half its value in 149 days, a male-biased ratio led $100 to lose half its value after only 60 days (see Figure 2).

Supporting our main prediction, Study 2 showed that perceptions of local sex ratio influenced men's desire for immediate rewards. Men opted for more immediate monetary rewards after being primed with a male-biased sex ratio. This experimental finding is consistent with the correlational finding in Study 1, which showed that male-biased sex ratios in U.S. cities are related to owning more credit cards and having higher levels of debt. The experimental male-only findings from Study 2 also indicate that these sex ratio effects in U.S. cities are likely driven by male consumers.

Sex ratio and intrasexual competition. Sex ratio is likely to produce effects on men's temporal discounting by influencing mating effort. Mating effort comprises both intersexual courtship and intrasexual competition. An important question is whether sex ratio is influencing men's temporal discounting because it is activating a mate-attraction motivation, an intrasexual competition motivation, or perhaps both motivations simultaneously.

To ascertain whether our sex ratio manipulations activated mate-attraction and/or an intrasexual competition motive, a separate group of 26 men underwent the male-biased or the female-biased photo array sex ratio manipulation as in Study 2. Participants then responded to two questions pertaining to *mate-attraction motivation*, indicating the extent to which the task led them to "Want to impress a potential romantic partner" and "Activate a desire to pursue a potential romantic partner." Participants also responded to two questions pertaining to *intrasexual competition motivation*, indicating the extent to which the task led them to "Feel more competitive toward other people of the same sex as you" and "Think that you would need to try harder if you wanted to outcompete other people of the same sex as you." Responses for each question were provided on a 9-point scale ranging from 1 (*not at all*) to 9 (*very much*). Questions were presented in randomized order.

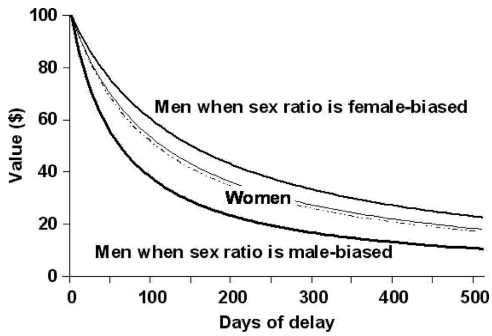

Figure 2. The value of a nominal $100 over time for men and women as a function of sex ratio in Study 2.

Findings showed that the two sex ratio manipulations produced no difference in reported mate-attraction motivation. Men did not differ across conditions in their desire to impress a potential romantic partner ($M_{\text{male-biased}} = 4.76$, $M_{\text{female-biased}} = 4.67$; $p = .90$) or in their desire to pursue a potential romantic partner ($M_{\text{male-biased}} = 4.06$, $M_{\text{female-biased}} = 3.89$; $p = .84$). However, the sex ratio manipulations produced significant differences in intrasexual competition motives for men. Men in the male-biased sex ratio condition felt significantly more competitive toward other men ($M_{\text{male-biased}} = 5.35$, $M_{\text{female-biased}} = 4.22$; $p = .025$), and they believed that they would need to try somewhat harder to outcompete other men ($M_{\text{male-biased}} = 5.30$, $M_{\text{female-biased}} = 4.56$; $p = .07$). These additional findings speak to the underlying mechanism by which skewed sex ratios likely lead men to make impulsive financial choices, suggesting that sex ratios influence men's mating effort by amplifying intrasexual competition.

Study 3: Sex Ratio, Saving, and Borrowing

Study 3 aimed to conceptually replicate and extend the findings from the first two studies. Although measures of temporal discounting (see Study 2) provide a theoretical foundation for understanding variation in preferences, it remains to be seen whether sex ratio directly affects more realistic financial preferences, such as those examined in the initial correlational study. Thus, we examined the degree to which sex ratio would influence two types of impulsive financial outcomes: (a) intentions to go into debt for immediate access to financial resources and (b) intentions to save money for the future.

In Study 3, participants read news articles describing the local population as either male-biased or female-biased. Participants then indicated how much money they would save each month from a paycheck, as well as how much money they would borrow each month (via interest-bearing credit cards) for immediate expenditures. We predicted that male-biased sex ratios would lead men to (a) save less money each month, so that more money would be available for immediate expenditures, and (b) be more willing to borrow money (i.e., incur more credit card debt) for immediate expenditures. Because Study 2 showed that findings in the neutral control condition were identical to those in the female-biased sex ratio condition, in the current study we focused only on contrasting male-biased and female-biased sex ratio conditions.

Method

Participants. In this study, 99 university students (53 female) participated for course credit. Mean age of participants was 20.55 ($SD = 1.73$), and the range was 18–29.

Design and procedure. A 2 × 2 design with participant sex and sex ratio as between-subjects factors was used. Participants first read a short news article about male and female students on campus. Then participants responded to items regarding saving and borrowing money.

To minimize suspicion, we told participants that the session involved multiple studies, the first of which concerned memory for news material. Consistent with this cover story, participants read a short news article, purportedly selected because it was recent, relevant for students, and exactly 500 words, making it ideal for memory studies. After reading the article, participants responded to two items regarding financial preferences, ostensibly to allow time for memory decay. Poststudy interviews revealed no suspicion.

Sex ratio manipulation. Participants read one of two short news articles generated specifically for this study but ostensibly taken from the *Chicago Tribune* (a reputable newspaper located near their university). One article highlighted that the sex ratios on campuses are becoming female-biased, whereas the other article noted that sex ratios are becoming male-biased. For example, an article titled "Fewer Women for Every Man for Today's Students" described recent demographic data showing more men than women in certain age groups.

Dependent measures. To assess saving and borrowing preferences, we asked participants to consider the following: "You are about to start your first job after college. After taking out taxes and social security, you are left with $2000 of take-home monthly income. The $2000 will need to cover many expenses, including housing, food, utilities, transportation, clothing, travel, entertainment, and others."

Next, in counterbalanced order, participants completed items concerning their saving and borrowing preferences. The saving item read: "Of your $2000 of monthly take-home income, how much money do you intend to set aside for savings each month?" Responses were made on an 11-point scale ranging from 1 (*$0*) to 11 (*$250 or more*) in $25 increments.

The borrowing item read: "After spending your paycheck on various expenses, you might have little or no disposable income left. However, you can borrow money (e.g., charge on credit card), whereby you would plan to pay back the money later. How much money would you be comfortable with borrowing each month to spend on things that you might not be able to afford?" Responses were made on an 11-point scale ranging from 1 (*$0*) to 11 (*$250 or more*) in $25 increments.

Results and Discussion

Saving. An ANOVA revealed a marginally significant Sex Ratio × Participant Sex interaction, $F(1, 95) = 3.44$, $p = .067$, suggesting that sex ratio had different effects on men's and women's savings. The key prediction in the study was that, compared with a female-biased sex ratio, a male-biased ratio would lead men to save less money each month. Results were consistent with this prediction: Men saved less money in the male-biased sex ratio condition, $t(95) = 2.90$, $p = .005$, $d = 0.60$ (see Figure 3), cutting their monthly savings by 42% (from $150 to $87). Consistent with findings from the first study, sex ratio did not influence women's saving ($p = .97$).

Borrowing. For borrowing, an ANOVA revealed a marginally significant Sex Ratio × Participant Sex interaction, $F(1, 95) = 2.98$, $p = .087$, suggesting that sex ratio had different effects on men's and women's savings. The key prediction in the study was that, compared with female-biased sex ratios, a male-biased ratio would lead men to be more willing to borrow money (via credit cards) for immediate expenditures. Supporting this prediction, men borrowed more money in the male-biased sex ratio condition, $t(95) = 2.29$, $p = .025$, $d = 0.47$ (see Figure 3). Men were willing to borrow 84% more money each month (from $37 to $68) when there was a scarcity of women. Consistent with results from Study 2, sex ratio did not influence women's borrowing ($p = .59$).

Using a different method to manipulate perceived sex ratio, Study 3 showed a pattern of results highly consistent with the first

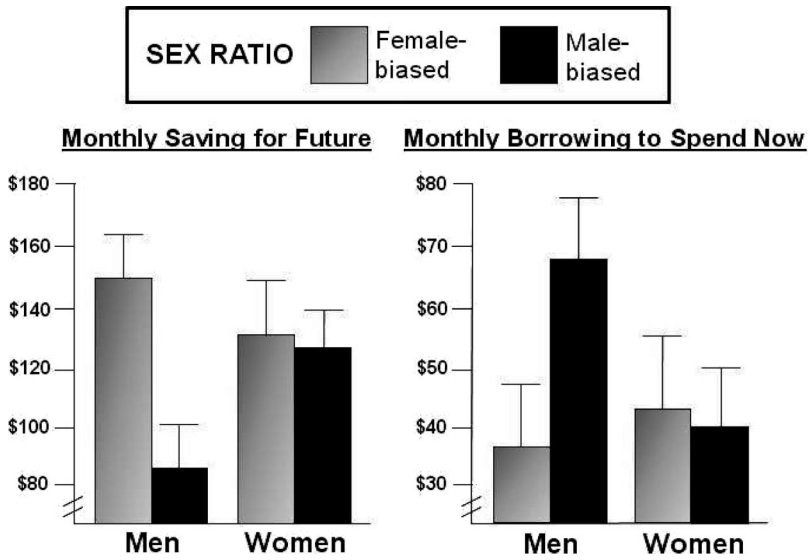

Figure 3. Men's and women's intended monthly saving and borrowing amount as a function of sex ratio in Study 3. Bars indicate standard errors.

two studies. When sex ratio is male-biased (a relative abundance of men), men placed more value on securing access to immediate resources. Men desired to both save less and borrow more money, prioritizing the acquisition of immediate gains—and even incurring future debt to do so. Further, sex ratio once again did not influence women's desire for immediate monetary resources. The sex-specific effects on desires for financial resources are consistent with cross-cultural patterns, which indicate that men tend to compete for and attract mates through displays or offerings that have monetary value more so than do women (Buss, 1989; Griskevicius et al., 2007; Li et al., 2002; Miller, 2009; Sundie et al., 2011). The findings from Study 3 also lend support to the interpretation that the real-world debt patterns found in Study 1 were driven by male consumers.

Study 4: Sex Ratio and Expected Spending

Whereas the first three studies tested how sex ratio influences men's desire for access to immediate resources, the final study examined whether sex ratio has parallel influences on men's spending of such monetary resources. Recall that in both humans and animals, male-biased sex ratios are associated with increased investment by males in mating effort (Barber, 2003; Drèze & Keher, 2000; Kvarnemo & Anhesjo, 1996; Taylor & Bulmer, 1980). Thus, if men value immediate financial yields under male-biased sex ratios as a means of allocating more resources toward mating effort, then men should spend more money on mating-related expenditures when the sex ratio is male-biased.

Study 4 examined whether sex ratio influenced the amount of money people expected men to pay for three common types of mating-related expenditures: a romantic Valentine's Day gift, an entrée for a dinner date, and an engagement ring. Because women become choosier and men invest more in mating effort under a male-biased sex ratio (Balshine-Earn, 1996; Kvarnemo & Forsgren, 2000), we predicted that men would be expected to pay more for mating-related expenditures when the sex ratio was male- rather than female-biased. This pattern should characterize both men's and women's expectations of male spending. Just as a male-biased ratio should motivate men to exert more mating effort, the same sex ratio should motivate women to increase their thresholds for what they consider acceptable in mates (Ackerman & Kenrick, 2009). As women become scarce, both sexes should expect men to spend more on mating-related products.

Method

Participants. In this study, 147 university students (81 female) participated for course credit. Mean participant age was 20.3 (SD = 1.68), and the range was 18–25.

Design and procedure. The study used a 2 × 2 between-subjects design with participant sex and sex ratio as factors. Sex ratio was manipulated with the news articles used in Study 3, and the same cover story was used. Poststudy interviews revealed no suspicion.

Dependent measures. After the sex ratio manipulation, participants responded to three conceptually similar questions regarding the amount of money expected to be spent on a gift for Valentine's Day, an entrée for a dinner date, and an engagement ring. For each item, responses were provided on a 12-point scale, whereby each option on the scale corresponded to a specific dollar amount. Pilot testing was used to establish the typical spending ranges for each product.

The three items were worded as follows. For the Valentine's Day gift: "If a man is planning to buy a woman he's been dating a nice gift for Valentine's Day, how much should he spend on her?" Response options ranged from 1 (*$10 or less*) to 12 (*$65 or more*) in $5 increments. For the entrée for a dinner date: "If a man asks a woman out to dinner, how nice of a restaurant should he take her to—that is, what should be the average price of an entrée for one person at this restaurant?" Response options ranged from 1 (*$7.50 or less*) to 12 (*$35 or more*) in $2.50 increments. For the engagement ring: "If a man proposes to a woman he's been dating, how much should he spend on the engagement ring for her?" Response options ranged from 1 (*$500 or less*) to 12 (*over $3000*) in $250 increments.

Results and Discussion

We predicted that a male-biased sex ratio would lead people to expect men to pay more for the same mating-related products. Supporting this prediction, analysis of a composite of the three products showed that a male-biased sex ratio led people to expect men to spend more money, $t(143) = 3.18$, $p = .001$, $d = 0.57$ (see Figure 4). An ANOVA did not reveal a Sex Ratio × Participant Sex interaction, meaning that sex ratio had a similar effect for men and women. However, there was a main effect of participant sex, indicating that male participants expected men to spend more money compared with what female participants expected men to spend (product-specific means appear in the next paragraph).

Individually, for the Valentine's Day gift, participants expected men to spend $6.01 more in the male-biased condition, $t(143) = 3.22$, $p = .002$, $d = 0.54$ (male participants: $M_{\text{female-biased}} = \$46.71$, $M_{\text{male-biased}} = \$53.46$; female participants: $M_{\text{female-biased}} = \$38.33$, $M_{\text{male-biased}} = \$45.50$). For a dinner date, participants expected men to spend $1.51 more on an entrée, $t(143) = 1.86$, $p = .065$, $d = 0.31$ (male participants: $M_{\text{female-biased}} = \$16.19$, $M_{\text{male-biased}} = \$17.28$; female participants: $M_{\text{female-biased}} = \$13.91$, $M_{\text{male-biased}} = \$16.30$). For an engagement ring, participants expected men to spend $368 more, $t(143) = 2.58$, $p = .011$, $d = 0.43$ (male participants: $M_{\text{female-biased}} = \$2{,}270$, $M_{\text{male-biased}} = \$2{,}674$; female participants: $M_{\text{female-biased}} = \$2{,}023$, $M_{\text{male-biased}} = \$2{,}348$). Thus, both men and women expected men to spend more money on mating-related products when women were scarce.

Study 4 showed that sex ratios can influence spending expectations of both men and women. Although sex ratio does not appear to influence women's desire to acquire immediate financial resources (see Studies 2 and 3), sex ratio does influence women's expectations for how men should spend their money. Women expect men to spend more financial resources on mating effort when sex ratio is male-biased, consistent with the notion that women become choosier in such conditions. Similarly, because men need to exert more mating effort when the sex ratio is male-biased, men also expect that their rivals will need to expend more resources in their mating effort.

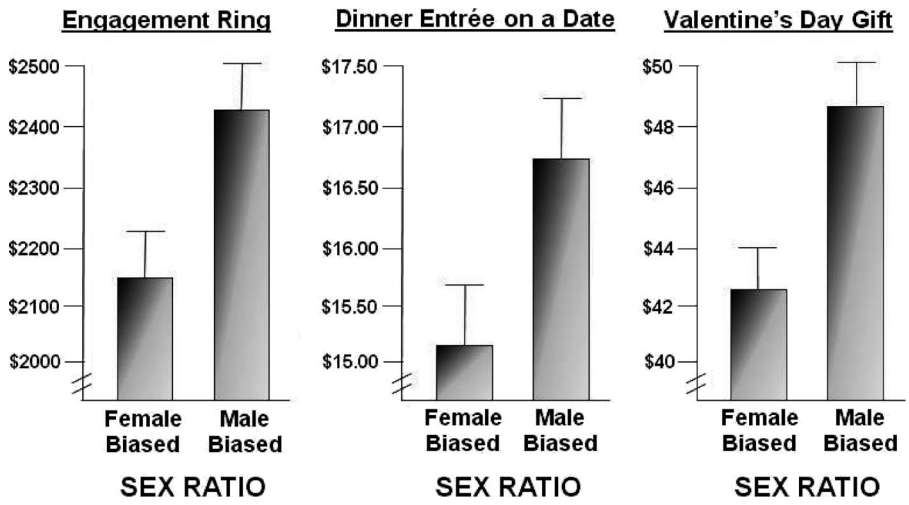

Figure 4. Dollar amount people expect men to spend on three different mating-related products as a function of sex ratio in Study 4. Bars indicate standard errors.

General Discussion

At the outset of this article, we considered differences in the financial habits of people living in two U. S. cities located less than 100 miles apart. Whereas individuals living in Macon, Georgia, have one of the lowest consumer debt rates in the United States, individuals living in Columbus, Georgia, have one of the highest debt rates in the country. We suggested that this difference in consumer debt may be related to an often overlooked difference between the two cities: the ratio of adult men to women in each area. Whereas Macon has substantially more women than men, Columbus has more men than women.

Building on evolutionary biological research in animal behavior (Kvarnemo & Anhesjo, 1996; Taylor & Bulmer, 1980) and population-level correlational research in humans (see e.g., Pollet & Nettle, 2008; Schmitt, 2005; Stone et al., 2007), we proposed that sex ratio may influence consumer spending and economic decision making. Looking at financial behavior in 134 U.S. cities, we found that male-biased sex ratios are associated with having more credit cards and higher debt (see Study 1). As men become more abundant in populations, American consumers desire access to immediate rewards.

This correlational study was followed by a series of experiments that manipulated perceived sex ratio. Male-biased sex ratios led men to prefer immediate rewards. Men chose sooner, smaller monetary gains rather than waiting for larger, future gains (see Study 2); men decreased intentions to save money, cutting their intended yearly savings by an average of $756 (see Study 3); and men were more willing to go into debt via credit cards, increasing yearly borrowing by an average of $372 (see Study 3). This robust pattern was obtained regardless of whether perceived sex ratio was manipulated via photographs (see Study 2) or via news articles (see Study 3) and regardless of whether the studies used real monetary incentives (see Study 2) or hypothetical financial intentions (see Study 3).

Building on the finding that sex ratio influences men's desire to access monetary resources, we also examined whether sex ratio has parallel influences on expectations about men's spending. Male-biased sex ratios led both men and women to expect men to pay more for mating-related products (see Study 4). This pattern of findings is consistent with the notion that male-biased sex ratios are associated with increased male investment in mating effort (Barber, 2003; Drèze & Keher, 2000; Kvarnemo & Anhesjo, 1996; Taylor & Bulmer, 1980). These findings also have implications for women's behavior. Although sex ratio does not appear to influence women's desire to acquire financial resources (see Studies 2 and 3), sex ratio does influence women's expectations of how men will spend their money. Because women are scarce in male-biased ecologies, women can set higher standards for what they consider acceptable in potential mates, including how much men spend on courtship. As witnessed in Study 4, sex ratios can influence the psychologies of both men and women.

In summary, our findings highlight people's sensitivity to a particular feature of the social environment—the ratio of reproductive-age men to women. We found that just as sex ratio has important effects on animal behavior, sex ratio has theoretically consistent effects on human behavior. However, the effects of sex ratio on humans are not limited to traditional domains of study such as mating, parenting, and aggression. Instead, sex ratio also influences other life domains that may be even more relevant to daily behavior. The current studies suggest that sex ratio might have far-reaching consequences for many economic decisions and, potentially, whole economies.

Sex Ratio and Money Across Cultures

In this research, we used archival data from U.S. cities and experimental data from U.S. participants to test hypotheses of how skewed sex ratios influence financial decisions. It is possible that skewed sex ratios may have different effects in different social ecologies. Consider that skewed sex ratios are increasingly characteristic of many Asian countries (Gu & Roy, 1995; Guilmoto, 2009; Jha et al., 2006; Sahni et al., 2008). In the most striking case, China will soon have a surplus of over 40 million adult men, producing an adult sex ratio of over 1.2 men for every woman (Hesketh, 2009).

Researchers have recently begun examining how the surplus of men in China may be influencing financial habits. Correlational data suggest that, in contrast with our U.S.-based findings, male-biased sex ratios in China are associated with higher savings rates (Wei & Zhang, 2009). At first glance, this pattern appears to be inconsistent with our current findings, which show that male-biased sex ratios are associated with increases in American men's spending and decreases in American men's savings.

We believe that both American and Chinese sex ratio effects share a core theoretical commonality, but the financial findings diverge due to particular cultural reasons. The effects of sex ratio in both cultures are likely rooted in evolutionary biology and mating economics: As women become scarce, men in both cultures amplify intrasexual competition and invest in mating effort. However, on average, men from the United States are likely to use somewhat different mating tactics than do men in China. Whereas American men may be more likely to invest in mating effort by borrowing, spending, and conspicuously displaying wealth, Chinese men may be more likely to invest in mating effort by saving money. There are several cultural reasons for this possible difference in mating tactics across the two cultures.

Unlike the United States, China has a cultural tradition of paying a bride price, which requires the groom or the groom's family to pay a large sum of money to acquire a bride. When women become scarce, the bride price increases. A male-biased sex ratio may therefore lead men seeking a bride to save more money in order to meet this higher financial threshold and to effectively compete with other suitors (Wei & Zhang, 2009). In fact, data on Chinese financial planning indicate that family (parental) savings for sons' weddings account for a large part of the increase in savings rates and that family savings rates decline after these weddings (Wei & Zhang, 2009). In contrast, the United States does not have a cultural tradition of a bride price. In Western cultures women tend to be courted through elaborate, conspicuous, and repeated financial displays (Miller, 2009). Thus, whereas men in one culture may tend to invest in mating effort by saving money for a one-time expenditure (bride price), men in another culture may tend to invest in mating effort by increasing immediate spending on courtship and mate competition.

Additionally, the United States and China may exhibit population-level differences in chronic mating strategies. Mating strategies can vary from opportunistic, short-term mating (e.g., having many sexual partners without a committed relationship) to long-term mating (e.g., monogamous marriage). Recent research shows that conspicuous consumption is specifically associated with a short-term mating strategy (Sundie et al., 2011). Thus, American men may be more likely to respond to male-biased sex ratios by wanting to spend money because, on average, they are more oriented toward a short-term mating strategy. Cross-cultural data on mating strategies supports this possibility. Schmitt (2005) recently reported Sociosexual Inventory (SOI) scores from countries around the world. The SOI measures openness to "unrestricted" sex (i.e., sex outside of a committed relationship), with higher scores indicating greater orientation toward short-term mating. Schmitt reports that the average U.S. SOI score is 37.05. Although data on Chinese SOI is not reported, SOI scores for closely related regions such as Taiwan (19.22) and Hong Kong (22.9) are only about half as high, suggesting that individuals in East Asian countries are much less oriented toward short-term mating than are the populations sampled in the current studies. Given the link between short-term orientations and conspicuous consumption (and, presumably, borrowing and spending rather than saving), cultural differences in mating strategies may produce cultural differences in how unbalanced sex ratios impact financial behavior. Future research is needed to better understand when and why sex ratio might have similar or different effects across cultures.

Limitations, Implications, and Future Directions

Our findings on how sex ratio influences psychology and behavior add to and complement the larger literature on evolution and cognition (see e.g., Ackerman et al., 2006; Griskevicius, Goldstein, Mortensen, Cialdini, & Kenrick, 2006; Griskevicius, Goldstein, et al., 2009; Kenrick, Griskevicius, Neuberg, & Schaller, 2010; Maner et al., 2005; Roney, 2003) and evolution and consumer behavior (see e.g., Durante, Griskevicius, Hill, Perilloux, & Li, 2011; Griskevicius, Shiota, & Nowlis, 2010; Kenrick et al., 2009). Whereas previous research has found that sexual cues such as photographs of attractive women lead men to discount the future (Van den Bergh et al., 2008; Wilson & Daly, 2004), our findings highlight people's sensitivity to a particular, evolutionarily important feature of the social environment—the relative availability of potential romantic partners.

We found that sex ratio influenced men's, but not women's, desire for immediate monetary gains (see Studies 2 and 3). These sex-specific patterns are consistent with the fact that, cross-culturally, men tend to compete for and attract mates through displays or offerings that have monetary value more than do women (Buss, 1989; Griskevicius et al., 2007; Li et al., 2002; Miller, 2009). However, the lack of effect on women's desire for accruing their own financial resources does not mean that sex ratio has no effect on women's broader desires or behavior. Indeed, we found that sex ratio did change women's preferences for how money is spent on them (see Study 4).

Further, in mating systems characterized by social monogamy and biparental investment (as is typically true for humans), changes in sex ratios are expected to affect the competitiveness of mating markets for both men and women (Marlowe, 2000; Pedersen, 1991). Although sex ratio may not influence women's desire for immediate monetary resources, it is likely to affect other female behaviors that promote successful competition for mates. For example, unfavorable (female-biased) sex ratios may influence female behaviors that are desirable to men, including increased signals of fidelity, decreased objections to or monitoring of men's potential infidelity, and other behaviors that enable women to be more competitive in mating success. Sex ratios may also be an important ecological cue in female development, leading to diverging adult behaviors as a function of the sex ratio in the local childhood environment (cf. Griskevicius, Delton, Robertson, & Tybur, 2011). For example, a scarcity of men may lead women to invest in mating effort at earlier ages, thereby leading to earlier female sexual maturation (see e.g., Ellis, 2004). Future research examining the precise influence of sex ratio on women's psychology, physiology, and behavior is likely to be fruitful.

In our final study, we found that at least some of the extra financial resources desired by American men under a male-biased sex ratio are expected to be spent on direct mating effort, such as

by paying more for dinner dates and engagement rings. Future research should examine how sex ratio might influence spending on other types of products. For example, it may be worthwhile for some men to spend their resources on obtaining an education, which can improve their competitiveness in the mating market. Indeed, the majority of students in the United States take out significant loans to finance their educations. Future research might examine the role of individual differences in response to sex ratios. One possibility, for example, is that men with purported markers of genetic fitness (e.g., symmetry, attractiveness, social dominance) might spend more money on immediate effort, whereas men who do not possess such markers might invest the money to first improve their own competitive ability, thereby increasing their future mating success. Nevertheless, using both archival and experimental methods, we consistently find that male-biased sex ratios lead men to want access to monetary resources, whereby these resources can then be allocated in various ways to enhance mating success.

The current research suggests that sex ratio may have important influences on many areas of life. In romantic relationships, for example, the perceived availability of mating alternatives in the local environment might influence relationship commitment or satisfaction (see e.g., Ackerman, Griskevicius, & Li, 2011; Campbell, Simpson, Boldry, & Kashy, 2005). When there is an abundance of alternatives, men and women may experience decreased relationship satisfaction; when there are abundant competitors, men and women may increase effort in stabilizing and maintaining their relationships. Although both men and women may be motivated to invest effort in relationship maintenance when there is an abundance of competitors, the tactics used to maintain relationships may vary across the sexes (see Buss & Shackelford, 1997). For example, when there is a scarcity of women, partnered men might become more vigilant and intrusive, attempting to prevent their partners from engaging in activities that might threaten the relationship. In contrast, when there is a scarcity of men, women in relationships might lower their demands for investment.

Variation in sex ratio might also warp perceptions of romantic partners (see e.g., Fletcher & Kerr, 2010). For example, female-biased ratios might lead women to develop positive illusions of their male partners, perceiving their current mates as being better than they really are. Such positive illusions could, in turn, motivate women to retain their mates in ways consistent with error management theory (Haselton et al., 2009; Haselton & Nettle, 2006). Because sex ratios can differ widely across populations, these imbalances may have interesting implications for relationships in different geographical regions. For example, given that Las Vegas has a male-biased population, the men who choose to live in this Mecca for indulgence might actually be more committed husbands than are their male counterparts in female-skewed cities.

Conclusion

Few people have considered that the ratio of men to women in the local population might influence consumer behavior and financial decisions. The fact that sex ratio has pronounced effects on economic outcomes is not surprising when one considers both theory in evolutionary biology and past research on operational sex ratios in numerous species. The relative number of same-sex rivals and available mates serves as a powerful environmental cue that signals what the current local environment holds in store for a given individual, including whether to prioritize immediate rewards or delay gratification. Indeed, it is notable that many contemporary economic and social problems have been caused by excessive behavior that has prioritized short-term rewards over long-term stability (e.g., investing in subprime mortgages, drilling for oil in delicate environments, skyrocketing debt). As the imbalance in sex ratios continues to remain in parts of the world or parts of a country, a better understanding of this powerful cue will become increasingly important.

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Appendix

Temporal Discounting Items in Study 2

k parameter	Amount to be received tomorrow	Amount to be received in 33 days
0.0005	$64	$65
0.001	$69	$71
0.002	$86	$92
0.003	$45	$49
0.004	$42	$47
0.005	$49	$57
0.006	$72	$86
0.008	$41	$51
0.01	$58	$76
0.015	$37	$54
0.02	$53	$87
0.025	$56	$99
0.03	$35	$67
0.035	$39	$81
0.04	$28	$62
0.05	$31	$78
0.06	$35	$98
0.08	$16	$55
0.1	$24	$94
0.2	$9	$60

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