

Mate Guarding and Frequent In-Pair Copulation in Humans

Concurrent or Compensatory Anti-Cuckoldry Tactics?

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Cuckoldry is an adaptive problem faced by parentally investing males of socially monogamous species (e.g., humans and many avian species). Mate guarding and frequent in-pair copulation (IPC) may have evolved as anti-cuckoldry tactics in avian species and in humans. In some avian species, the tactics are used *concurrently*, with the result that mate guarding behaviors and IPC frequency are correlated positively. In other avian species, the tactics are *compensatory*, with the result that mate guarding behaviors and IPC frequency are correlated negatively. The relationship between mate guarding and IPC frequency in humans is unknown. Avian males that use these tactics concurrently share with human males an inability to guard a female partner continuously during her peak fertile period. We hypothesized, therefore, that men's mate guarding and IPC frequency function as concurrent anti-cuckoldry tactics, resulting in a positive correlation between them. Study 1 ($n = 305$) secured men's self-reports of mate guarding and IPC frequency. Study 2 ($n = 367$) secured women's reports of their partners' mate guarding and IPC frequency. The concurrent tactics hypothesis was supported in both studies: Men's mate guarding and IPC frequency are correlated positively, and this association is not attributable to male age, female age, relationship satisfaction, relationship length, or time that the couple spends together. The Discussion section addresses potential limitations of this research and future research directions.

KEY WORDS: Anti-cuckoldry tactics; Copulation frequency; Mate guarding; Sperm competition

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Cuckoldry has been documented in many “socially monogamous” species (Birkhead and Møller 1992; McKinney, Cheng, and Bruggers 1984). In such species, males and females form long-term pair bonds but also pursue extra-pair copulations (EPCs). Because EPCs can result in extra-pair paternity, the term *social monogamy* is used to differentiate these species from those that are genetically monogamous. EPCs can result in the in-pair male investing in offspring that are not genetically his own (i.e., cuckoldry). Males of socially monogamous species therefore often evolve specialized tactics to prevent cuckoldry. Perhaps in part because of the relative ease with which their sexual behaviors and parental behaviors can be observed and documented, avian species have been a key target of intensive empirical research on anti-cuckoldry tactics. The avian literature has focused on two such tactics in particular: mate guarding behavior and frequent in-pair copulation (IPC).

In avian species, male mate-guarding behavior includes close following (e.g., in flight, staying within 2–10 seconds) and surveillance of the female (Birkhead 1979; Brylawski and Whittingham 2004). Although an effective tactic in many species, mate guarding behavior is not fail-safe as females sometimes are able to surmount their partner’s guarding efforts and obtain conceptive EPCs (Kempnaers, Verheyen, and Dhondt 1995). Frequent IPCs in avian species can serve as an anti-cuckoldry tactic by placing large numbers of sperm in competition with EPC sperm for access to ova (Birkhead, Atkin, and Møller 1987; McKinney et al. 1984). Accordingly, IPC frequency increases with greater risk of female EPC (Møller 1985; Mougeot, Arroyo, and Bretagnolle 2001). In some avian species, mate guarding behavior and frequent IPC are *concurrent* anti-cuckoldry tactics, resulting in a positive relationship between the use of the two tactics (Dickinson and Leonard 1996; Korpimäki et al. 1996; Mougeot et al. 2001). In other avian species, mate guarding behavior and frequent IPC are *compensatory* tactics, resulting in a negative relationship between the two (e.g., Alonzo and Warner 2000; Birkhead and Møller 1992; Møller and Birkhead 1991).

Like most avian species, humans are socially monogamous. Humans tend to form long-term pair bonds but also engage in occasional EPCs. Estimates of EPCs in terms of marital infidelity rates, for example, range from 15% to 50% for women and from 25% to 50% for men (Laumann et al. 1994; Simmons et al. 2004). Among foraging cultures—cultures that practice our ancestral lifestyle of hunting and gathering—infidelity rates tend to be high, with at least “occasional” extramarital sex taking place in more than 70% of preindustrial cultures from the Standard Cross-Cultural Sample (Broude and Greene 1976; see also Schmitt et al. 2004). Regardless of the cultural context, any man whose partner engages in EPC is at risk of cuckoldry and its associated costs. Like males of most avian species, men may use mate guarding and frequent IPC to guard against cuckoldry.

Buss (1988) identified specific mate guarding behaviors used by men to maintain their partner’s exclusive involvement with them. Examples of these behaviors (and associated higher-order tactics) include taking their partner away from a social gathering where other men are present (Concealment of Mate), dropping by unex-

pectedly to check up on their partner (Vigilance), and insisting that their partner stay home rather than go out (Monopolization of Time). Mate guarding behaviors vary in evolutionarily predictable ways (Trivers 1972). For example, men guard their partner more intensively when she is of greater reproductive value (as indexed by her youth and attractiveness) and when her perceived probability of EPC is greater (Buss and Shackelford 1997). Men who are mated to women who are more likely to engage in EPCs guard their partners more intensively (Goetz et al. 2005) and men guard their partner more intensively near ovulation—a time when an EPC would be most costly for the in-pair male (Gangestad, Thornhill, and Garver 2002).

Additional human male tactics may have evolved to combat cuckoldry, including those that focus on sperm competition (Gallup et al. 2003; Shackelford and LeBlanc 2001; Shackelford et al. 2002; Shackelford, Pound, and Goetz 2005; Shackelford, Pound, Goetz, and LaMunyon 2005; Smith 1984). Shackelford et al. (2002), for example, documented that men who spent a greater proportion of time apart from their partner since the couple's last copulation report that they find their partner more sexually attractive and that they have more interest in copulating with her. These perceptual changes may motivate men to copulate as soon as possible with their partner, thereby entering their sperm into competition with any rival sperm that may be present in her reproductive tract.

Another human male tactic that might be designed to decrease the likelihood of cuckoldry is frequent IPC. Baker and Bellis (1993) developed a “topping-up” model of strategic partitioning of sperm in which men replace in their partner's reproductive tract sperm lost through death and phagocytosis, and thereby increase the total functional sperm population in her reproductive tract. Frequent IPC thus may reduce the in-pair male's risk of cuckoldry (Baker and Bellis 1993). Frequent IPC as a sperm competition tactic may help to explain why men, but not women, continue to be interested in copulating with their partner over the duration of a mateship (Klusmann 2002). Although men report that their sexual satisfaction and the quality of marital sex declines with the duration of the mateship (Chien 2003; Klusmann 2002), men's desire for sexual intercourse with their partner does not decline with the duration of the mateship.

Thus, like males of several avian species, men use mate guarding behaviors and frequent IPC as anti-cuckoldry tactics. It is not yet known, however, whether men use mate guarding and frequent IPC as *concurrent* anti-cuckoldry tactics, like the western bluebird (*Sialia mexicana*) and the Eurasian kestrel (*Falco tinnunculus*) (Dickinson and Leonard 1996; Korpimaki et al. 1996), or as *compensatory* anti-cuckoldry tactics, like the Mediterranean wrasse (*Symphodus ocellatus*) and the Fiordland crested penguin (*Eudyptes pachyrhynchus*) (Alonzo and Warner 2000; Birkhead and Møller 1992). Mate guarding alone cannot guarantee cuckoldry avoidance, in part because it would not have been possible for an ancestral man to guard his partner continuously throughout her ovulatory cycle. Nor is frequent IPC a perfect anti-cuckoldry tactic: it may be met with obstacles, including female resistance (Chien 2003; Klusmann 2002) and semen displacement by rival males (Gallup et

al. 2003; Goetz et al. 2005). In avian species in which the male is unable to guard his partner continuously (e.g., in species in which a male provides his partner with food and in species in which the nesting site must be guarded from conspecifics), males use mate guarding behaviors and frequent IPC as concurrent tactics. We therefore hypothesize that men will use these tactics together as concurrent anti-cuckoldry tactics, resulting in a positive correlation between men's mate guarding behavior and IPC frequency. An alternative hypothesis is that men use these tactics in a compensatory manner, resulting in a negative correlation between the use of mate guarding and IPC frequency.

The hypothesized positive relationship between mate guarding behavior and IPC frequency may be an artifact of extraneous variables, however. Previous research has documented, for example, that both men's mate guarding behaviors and IPC frequency are correlated with male age, female age, relationship satisfaction, and relationship length (e.g., Buss and Shackelford 1997; Klusmann 2002). Because previous work indicates that these variables are correlated with men's mate guarding behaviors and with IPC frequency, any relationship between the two target variables might be spurious. In addition, the hypothesized positive relationship between the two tactics might be a spurious relationship attributable to the time that the couple spends together. Men who spend more time with their partners have greater opportunity to guard them and to pursue IPCs. It is important to control for these variables in an effort to identify a unique and genuine relationship between mate guarding behaviors and IPC frequency. *We hypothesize that men's mate guarding will be positively related to IPC frequency, independent of male age, female age, relationship satisfaction, relationship length, and time spent together.*

STUDY 1: MEN'S SELF-REPORTS OF MATE GUARDING AND IN-PAIR COPULATION FREQUENCY

In two studies, we investigated men's and women's experiences with mate guarding and IPC. Study 1 secured men's self-reports of their mate guarding behaviors and IPC frequency.

Methods

Participants. Three hundred five men, each of whom was in a committed, sexual relationship with a woman, participated in this study. Participants were drawn from universities and surrounding communities. The mean age of the participants was 25.8 years (s.d. = 8.6), the mean age of the participants' partners was 24.6 years (s.d. = 8.1), and the mean relationship length was 52.6 months (s.d. = 67.9).

Materials. Participants completed a survey that contained several sections. The first section requested demographic information, including the participant's age, his partner's age, and the length of his current relationship. The next section asked the participant to report how often in a typical week he and his partner have sexual

intercourse, the number of hours since the last time the couple had sexual intercourse, and the number of hours the couple has spent together since they last had sexual intercourse. Relationship satisfaction was assessed by the Relationship Satisfaction Scale (Shackelford and Goetz 2004; Shackelford et al. 2002), and the participant was asked to rate his overall, sexual, and emotional satisfaction with his partner. These ratings were made on a 10-point scale anchored by 0 = *Not at all* and 9 = *Extremely*.

To assess mate guarding behaviors, the last section of the survey included a subscale of the Mate Retention Inventory (MRI; Buss 1988) which asked how often the participant had performed 18 mate guarding acts in the last month, ranging from 0 (*Never*) to 3 (*Often*). Example acts include: “Insisted that my partner stay home rather than going out,” “Questioned my partner about what she did when we were apart,” “Did not take my partner to a party where other men would be present,” and “Monopolized my partner’s time at a social gathering.” Buss (1988; and see Buss and Shackelford 1997) has grouped these 18 acts into three tactics of mate guarding (Table 1). Previous research has established the reliability, validity, and utility of this measure as an assessment of mate guarding behaviors (Buss 1988; Buss and Shackelford 1997; Shackelford, Goetz, and Buss 2005).

Procedure. The prospective participant must have met three criteria to qualify for participation: he must be (1) male, (2) at least 18 years of age, and (3) currently involved in a committed, sexual relationship with a woman. Upon the prospective participant’s arrival at the scheduled time and location, the researcher confirmed that the prospective participant met the three participation criteria. If the criteria were met, the researcher handed the participant a consent form, the survey, and a security envelope. The participant was instructed to read and sign the consent form, complete the survey, place the completed survey in the envelope, and then seal the envelope. To maintain anonymity the participant was instructed not to seal the consent form inside the envelope. Upon completion of the survey, the researcher explained to the participant the purpose of the study, answered any questions, and thanked the participant for his participation.

Table 1. Correlations of Men’s Self-Reports of Mate Guarding with In-Pair Copulatory Frequency

Mate Guarding Tactic	Zero-Order Correlations	Partial Correlations
Overall Mate Guarding (.89)	.25	.28
Vigilance (.82)	.28	.28
Concealment of Mate (.65)	.16	.20
Monopolization of Time (.75)	.21	.24

$N = 305$; $\alpha =$ alpha reliability (shown in parentheses). All correlations are significant at $p < .0125$. Partial correlations controlled for male age, female age, relationship satisfaction, relationship length, and time spent together.

Results and Discussion

We calculated scores for men's overall mate guarding and the three mate guarding tactics using responses to the 18 acts, following Buss (1988). Alpha reliabilities for the tactics varied in this study from .65 to .82 (Table 1). To test the concurrent tactics hypothesis that men's mate guarding is related positively to IPC frequency, we first calculated zero-order correlations between IPC frequency and scores on the three mate guarding tactics and overall mate guarding. We instituted a Bonferroni correction for α inflation, resulting in a corrected alpha level of $.05 / 4 = .0125$. Consistent with the concurrent tactics hypothesis, all four correlations were positive and statistically significant (Table 1).

Because men's mate guarding behaviors and IPC frequency are both known to correlate with male age, female age, relationship satisfaction (mean of three items; α in current study = .84), and relationship length (e.g., Buss and Shackelford 1997; Klusmann 2002), we calculated partial correlations between men's mate guarding behaviors and IPC frequency controlling for these four variables. In addition, because men who spend more time with their partners have greater opportunity to pursue IPCs and to guard their partners, we controlled for an approximation of time spent together. We calculated the proportion of time spent together by dividing the number of hours the couple had spent together since they last had sexual intercourse by the total number of hours since the last time the couple had sexual intercourse (following Shackelford et al. 2002). After controlling for male age, female age, relationship, relationship length, and time spent together, all four correlations remained statistically significant and positive (Table 1). To identify differences between the parallel zero-order and partial correlations, we performed Fisher's r -to- z transformations and the associated tests of differences in z -values (Cohen and Cohen 1983). None of these tests produced significant differences (i.e., the zero-order correlations did not differ significantly from the partial correlations; analyses available upon request). With significant positive correlations between IPC frequency and mate guarding behaviors even after controlling for male age, female age, relationship satisfaction, relationship length, and time spent together, the hypothesis that men's mate guarding and IPC frequency are concurrent anti-cuckoldry tactics was supported.

STUDY 2: WOMEN'S OBSERVER-REPORTS OF PARTNER'S MATE GUARDING AND IN-PAIR COPULATION FREQUENCY

The reliability of men's reports of their mate guarding behaviors and their IPC frequency can be questioned on several fronts. First, men sometimes underreport their guarding and controlling behavior, whereas women report this behavior with relative accuracy (e.g., Dobash et al. 1998; Magdol et al. 1997; Shackelford, Goetz, Buss, Euler, and Hoier 2005). Second, men's continued interest in copulation throughout the duration of the mateship, coupled with women's waning sexual interest

(Klusmann 2002), may cause men to underestimate IPC frequency. Women's reports of men's mate guarding and IPC frequency may reflect more accurately the incidence of such behaviors, and examining observer-reported guarding behavior and IPC frequency provides an important avenue for evaluating the generalizability of Study 1 findings. Using an independent sample of women in committed, sexual relationships, Study 2 secured women's observations of their partner's mate guarding behaviors and IPC frequency. These independent reports offered an additional test of the concurrent tactics hypothesis tested in Study 1. *We hypothesize that women's reports of their partner's mate guarding will be related positively to IPC frequency, independent of male age, female age, relationship satisfaction, relationship length, and time spent together.*

Methods

Participants. Three hundred sixty-seven women, each of whom was in a committed, sexual relationship with a man, participated in this study. Participants were drawn from universities and surrounding communities. The mean age of the participants was 22.4 years (s.d. = 6.1), the mean age of the participants' partners was 24.5 years (s.d. = 7.4), and the mean relationship length was 40.9 months (s.d. = 42.8). The women who participated in Study 2 were not mated to the men who participated in Study 1; hence the slight differences in sample demographics. The average age of women in Study 2 was younger than the average age of men's partners in Study 1, $t_{670} = 4.01$, $p < .001$. The women's partners in Study 2 were only slightly younger than the men in Study 1, $t_{670} = 2.11$, $p < .05$. Finally, the average length of relationship was somewhat longer in Study 1, $t_{670} = 2.72$, $p < .01$. In addition to the use of observer reports, Study 2 demographics offer further possibilities for evaluating the generalizability of Study 1 findings.

Materials. The survey used in Study 2 was identical to that of Study 1, with the exception that participants reported on their partner's mate guarding behaviors using a partner-report version of the MRI (Buss 1988; Shackelford, Goetz, and Buss 2005) used in Study 1.

Procedure. Paralleling Study 1, three criteria must have been met to qualify for participation: the prospective participant must be (1) female, (2) at least 18 years of age, and (3) currently involved in a committed, sexual relationship with a man. Upon the prospective participant's arrival at the scheduled time and location, the researcher confirmed that the prospective participant met the three participation criteria. The same procedure was followed as in Study 1.

Results and Discussion

As in Study 1, we calculated scores for overall mate guarding and the three mate guarding tactics using responses to the 18 acts, following Buss (1988). Alpha reliabilities for the tactics varied in this study from .72 to .84 (Table 2). To test the

Table 2. Correlations of Women's Reports of Partner's Mate Guarding with In-Pair Copulatory Frequency

Mate Guarding Tactic	Zero-Order Correlations	Partial Correlations
Overall Mate Guarding (.89)	.23	.28
Vigilance (.84)	.18	.19
Concealment of Mate (.72)	.19	.24
Monopolization of Time (.79)	.25	.30

$N = 367$; α = alpha reliability (shown in parentheses). All correlations are significant at $p < .0125$. Partial correlations controlled for male age, female age, relationship satisfaction, relationship length, and time spent together.

concurrent tactics hypothesis that women's reports of their partner's mate guarding will be related positively to IPC frequency, we first calculated zero-order correlations between IPC frequency and scores on the three mate guarding tactics and overall mate guarding. We instituted a Bonferroni correction for α inflation, resulting in a corrected α level of $.05 / 4 = .0125$. Consistent with the concurrent tactics hypothesis, all four correlations were positive and statistically significant (Table 2).

Following the logic and analyses presented in Study 1, we next computed partial correlations between men's mate guarding behaviors and IPC frequency, controlling for male age, female age, relationship satisfaction ($\alpha = .78$), relationship length, and time spent together. All four correlations remained positive and statistically significant (Table 2). To identify differences between the parallel zero-order and partial correlations, we performed Fisher's r -to- z transformations and the associated tests of differences in z -values. None of these tests produced significant differences (i.e., the zero-order correlations did not differ significantly from the partial correlations; analyses available upon request). With significant positive correlations between IPC frequency and partner-reported mate guarding behaviors, even after controlling for male age, female age, relationship satisfaction, relationship length, and time spent together, the hypothesis that men's mate guarding behaviors and IPC frequency are concurrent anti-cuckoldry tactics was supported.

Finally, to identify differences between the correlations of (1) men's self-reports of their mate guarding behaviors and IPC frequency and (2) women's observer-reports of their partner's mate guarding behaviors and IPC frequency, we performed Fisher's r -to- z transformations on both sets of zero-order and partial correlations. None of the eight correlations from the men's data was significantly different from the parallel eight correlations from the women's data (all z values < 1.0 , all p values $> .05$; analyses available upon request).

GENERAL DISCUSSION

After successfully attracting a long-term partner, men encounter a new set of mating challenges, including cuckoldry avoidance. Men may have evolved at least two anti-cuckoldry tactics: mate guarding and frequent IPC. If mate guarding fails, and his partner temporarily copulates with another man, the current research suggests that men may be equipped with a psychology designed to motivate frequent IPC, to “correct” the infidelity. According to both men’s self-reports and women’s observer-reports, men’s mate guarding and frequent IPC appear to function *concurrently* as anti-cuckoldry tactics. These findings corroborate the findings of Goetz et al. (2005), who provided evidence that mate guarding and semen-displacing copulatory behaviors function as concurrent anti-cuckoldry tactics in humans. In addition, the current findings suggest that human males behave similarly to the males of other socially monogamous species, notably many avian species—when unable to guard a female partner throughout her fertile period, males deploy both mate guarding behaviors and frequent IPC (Dickinson and Leonard 1996; Korpimaki et al. 1996; Mougeot et al. 2001).

Across both studies, controlling statistically for male age, female age, relationship satisfaction, relationship length, and time spent together did not change the pattern of results. Despite the fact that previous research indicates that men’s mate guarding behaviors and IPC frequency are both related to these variables (e.g., Buss and Shackelford 1997; Klusmann 2002), the significant partial correlations suggest that men’s mate guarding behaviors and IPC frequency are concurrent anti-cuckoldry tactics that are independent of extraneous factors. In addition, the same pattern of correlations between men’s mate guarding behaviors and IPC frequency was observed across men’s self-reports and an independent sample of women’s partner-reports, suggesting that the pattern of relationships is reliable and not limited to the uniquely biased perceptions of one sex or the other.

We applied a comparative evolutionary perspective to study the relationship between men’s mate guarding and IPC frequency. Because humans share similar adaptive problems with many avian species (e.g., social monogamy, cuckoldry), Shackelford and LeBlanc (2001) and others (e.g., Wilson and Daly 1992) have argued that humans may share with these avian species similar solutions to these adaptive problems (e.g., mate guarding and frequent IPC as anti-cuckoldry tactics). This perspective has proven successful in discovering an arsenal of anti-cuckoldry tactics in men (Shackelford, Pound, and Goetz 2005) and, in the current research, has elucidated the relationship between two of these tactics.

LIMITATIONS AND FUTURE DIRECTIONS

We asked participants to report the number of times they have sexual intercourse with their partner in a typical week. Because these data are composed of participants’ estimations of IPC frequency, there will be reporting errors. The young men

and women in these samples, however, report having sexual intercourse with their partner an average of 3.3 times per week (s.d. = 2.6) according to the men and 3.4 times per week (s.d. = 2.9) according to the women, statistics that are consistent with previous reports of average IPC frequency among young couples (e.g., Baker and Bellis 1995; Smith 1984).

A second potential limitation of this research is the reliance on the same individual's reports of men's mate guarding behaviors and IPC frequency. Future work might secure from each member of mated couples reports of both classes of behaviors, and then compute cross-partner averages. Such reports could be used to produce more reliable assessments of men's mate guarding behaviors and IPC frequency (e.g., Buss and Shackelford 1997; Shackelford, Goetz, and Buss 2005).

The concurrent tactics hypothesis tested in the current research assumes that men are the initiators of IPCs, but we did not assess who initiated them. It is possible that women who are more intensively mate-guarded respond by initiating IPCs in an effort to placate jealous men. It is also possible that women who initiate more IPCs elicit worry or suspicion in their partners, and men respond to this increase in partner-initiated IPCs by engaging in more mate guarding behaviors. Other research, however, indicates that it is clearly men who most often initiate IPCs (see, e.g., Buss 2003; Symons 1979). Men, for example, are continually interested in copulating with their partner for the duration of a mateship, whereas women are not (Klusmann 2002). If there is a calculated pathway along which IPCs lead to mate guarding behaviors, it seems likely that men are actively involved in the engagement of this strategy.

There are several additional directions for future research. It might be useful to employ a daily diary methodology that is capable of tracking variations in IPC frequency and men's mate guarding behaviors in relation to women's ovulatory cycle, for example. During the ovulatory phase when in-pair males are at greatest risk of cuckoldry, we hypothesize that both IPC frequency and men's mate guarding behaviors will increase concomitantly (e.g., Gangestad et al. 2002). Future research also might address the copulatory psychology and behavior of women. Motivated to obtain genetic benefits from EPCs, for example, some women might attempt to resist their partner's mate guarding behaviors and IPC attempts. One hypothesis is that women mated to men with indicators of poor genetic quality will resist their partner's mate guarding behaviors and IPC attempts more than women mated to men with indicators of high genetic quality (see, e.g., Pillsworth, Haselton, and Buss 2004).

Although the current research provides preliminary evidence that male mate guarding and frequent IPC are used together as concurrent anti-cuckoldry tactics, the two classes of tactics may not be inextricably entwined. There might be situations in which one anti-cuckoldry tactic is deployed without the other. Following the discovery of his partner's sexual infidelity, for example, we hypothesize that men may forgo mate guarding behaviors and instead increase IPC frequency. It may be too late for an in-pair male to deploy mate guarding behaviors if his partner has

already been inseminated by an extra-pair male. Future research thus might investigate men's mate guarding and IPC behaviors following a man's discovery of his partner's recent sexual infidelity.

Finally, it is important to note that the current research was designed to investigate *across a group of men* the relationships between in-pair copulatory frequency and men's mate guarding of female partners. This research was not intended to investigate these relationships for individual men in different contexts or over time with the same or different female partners. Many of the future directions suggested above address such *within-sex* variations. Clearly, men do not have infinite energy budgets. Like all behaviors, the deployment of anti-cuckoldry tactics will entail costs, such as time, effort, and energy. How individual men trade the benefits of anti-cuckoldry behaviors for the costs of deploying such behaviors is an important direction for future research.

CONCLUSION

The current research provides information about the design of the human male mind—namely, that it is equipped to motivate the concurrent deployment of at least two anti-cuckoldry tactics, mate guarding and frequent IPC. In addition, this research highlights the utility of a comparative evolutionary perspective, as advocated by Daly and Wilson (1999; Wilson and Daly 1992) and Shackelford and his colleagues (e.g., Shackelford and LeBlanc 2001; Shackelford, Pound, and Goetz 2005).

NOTE

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REFERENCES

- Alonzo, S. H., and R. R. Warner
2000 Allocation to Mate Guarding or Increased Sperm Production in a Mediterranean Wrasse. *American Naturalist* 156:266–275.
- Baker, R. R., and M. A. Bellis
1993 Human Sperm Competition: Ejaculate Adjustment by Males and the Function of Masturbation. *Animal Behaviour* 46:861–885.
1995 *Human Sperm Competition*. London: Chapman & Hall.
- Birkhead, T. R.
1979 Mate Guarding in the Magpie *Pica pica*. *Animal Behaviour* 30:277–283
- Birkhead, T. R., and A. P. Møller
1992 *Sperm Competition in Birds*. London: Academic Press.
- Birkhead, T. R., L. Atkin, and A. P. Møller
1987 Copulation Behaviour of Birds. *Behaviour* 101:101–138.
- Broude, G. J., and S. J. Greene
1976 Cross-Cultural Codes on Twenty Sexual Attitudes and Practices. *Ethnology* 15:409–430.
- Brylawski, A. M. Z., and L. A. Whittingham
2004 An Experimental Study of Mate Guarding and Paternity in House Wrens. *Animal Behaviour* 68:1417–1424.
- Buss, D. M.
1988 From Vigilance to Violence: Tactics of Mate Retention in American Undergraduates. *Ethology and Sociobiology* 9:291–317.
2003 *The Evolution of Desire*, revised ed. New York: Basic Books.
- Buss, D. M., and T. K. Shackelford
1997 From Vigilance to Violence: Mate Retention Tactics in Married Couples. *Journal of Personality and Social Psychology* 72:346–361.
- Chien, L.
2003 Does Quality of Marital Sex Decline with Duration? *Archives of Sexual Behavior* 32:55–60.
- Cohen, J., and P. Cohen
1983 *Applied Multiple Regression/Correlation Analysis for the Behavioral Sciences*. Hillsdale, NJ: Erlbaum.
- Daly, M., and Margo Wilson
1999 Human Evolutionary Psychology and Animal Behaviour. *Animal Behaviour* 57:509–519.
- Dickinson, J. L., and M. L. Leonard
1996 Mate Attendance and Copulatory Behaviour in Western Bluebirds: Evidence of Mate Guarding. *Animal Behaviour* 52:981–992.
- Dobash, R. E., R. P. Dobash, K. Cavanagh, and R. Lewis
1998 Separate and Intersecting Realities: A Comparison of Men's and Women's Accounts of Violence against Women. *Violence against Women* 4:382–414.
- Gallup, G. G., R. L. Burch, M. L. Zappieri, R. A. Parvez, M. L. Stockwell, and J. A. Davis
2003 The Human Penis as a Semen Displacement Device. *Evolution and Human Behavior* 24:277–289.
- Gangestad, S. W., R. Thornhill, and C. E. Garver
2002 Changes in Women's Sexual Interests and Their Partner's Mate-Retention Tactics across the Menstrual Cycle: Evidence for Shifting Conflicts of Interest. *Proceedings of the Royal Society of London* 269:975–982.
- Goetz, A. T., T. K. Shackelford, V. A. Weekes-Shackelford, H. A. Euler, S. Hoier, D. P. Schmitt, and C. W. LaMunyon
2005 Mate Retention, Semen Displacement, and Human Sperm Competition: A Preliminary Investigation of Tactics to Prevent and Correct Female Infidelity. *Personality and Individual Differences* 38:749–763.
- Kempenaers, B., G. R. Verheyen, and A. A. Dhondt
1995 Mate Guarding and Copulation Behaviour in Monogamous and Polygynous Blue Tits: Do Males Do a Best-of-Bad-Job Strategy? *Behavioral Ecology and Sociobiology* 36:33–42.

- Klusmann, D.
2002 Sexual Motivation and the Duration of Partnership. *Archives of Sexual Behavior* 31:275–287.
- Korpimäki, E., K. Lahti, C. A. May, D. T. Parkin, G. B. Powell, P. Tolonen, and J. H. Wetton
1996 Copulatory Behaviour and Paternity Determined by DNA Fingerprinting in Kestrels: Effects of Cyclic Food Abundance. *Animal Behaviour* 51:945–955.
- Laumann, E. O., J. H. Gagnon, R. T. Michael, and S. Michaels
1994 *The Social Organization of Sexuality*. Chicago: University of Chicago Press.
- Magdol, L., T. E. Moffitt, A. Caspi, D. L. Newman, J. Fagan, and P. A. Silva
1997 Gender Differences in Partner Violence in a Birth Cohort of 21-year-olds: Bridging the Gap between Clinical and Epidemiological Approaches. *Journal of Consulting and Clinical Psychology* 65:68–78.
- McKinney, F., K. M. Cheng, and D. J. Bruggers
1984 Sperm Competition in Apparently Monogamous Birds. In *Sperm Competition and Evolution of Animal Mating Systems*, R. L. Smith, ed. Pp. 523–545. New York: Academic Press.
- Møller, A. P.
1985 Mixed Reproductive Strategy and Mate Guarding in a Semi-colonial Passerine, the Swallow *Hirundo rustica*. *Behavioral Ecology and Sociobiology* 17:401–408.
- Møller, A. P., and T. R. Birkhead
1991 Frequent Copulations and Mate Guarding as Alternative Paternity Guards in Birds: A Comparative Study. *Behaviour* 118:170–186.
- Mougeot, F., B. E. Arroyo, and V. Bretagnolle
2001 Decoy Presentations as a Means to Manipulate the Risk of Extrapair Copulation: An Experimental Study in a Semicolonial Raptor, the Montagu's Harrier (*Circus pygargus*). *Behavioral Ecology* 12:1–7.
- Pillsworth, E. G., M. G. Haselton, and D. M. Buss
2004 Ovulatory Shifts in Female Sexual Desire. *Journal of Sex Research* 41:55–65.
- Schmitt, D. P., L. Alcalay, J. Allik, A. Angleiter, L. Ault, I. Austers, et al.
2004 Patterns and Universals of Mate Poaching across 53 Nations: The Effects of Sex, Culture, and Personality on Romantically Attracting Another Person's Partner. *Journal of Personality and Social Psychology* 86:560–584.
- Shackelford, T. K., and A. T. Goetz
2004 Men's Sexual Coercion in Intimate Relationships: Development and Initial Validation of the Sexual Coercion in Intimate Relationships Scale. *Violence and Victims* 19:21–36.
- Shackelford, T. K., and G. J. LeBlanc
2001 Sperm Competition in Insects, Birds, and Humans: Insights from a Comparative Evolutionary Perspective. *Evolution and Cognition* 7:194–202.
- Shackelford, T. K., A. T. Goetz, and D. M. Buss
2005 Mate Retention in Marriage: Further Evidence of the Reliability of the Mate Retention Inventory. *Personality and Individual Differences* 39:415–425.
- Shackelford, T. K., A. T. Goetz, D. M. Buss, H. A. Euler, and S. Hoier
2005 When We Hurt the Ones We Love: Predicting Violence against Women from Men's Mate Retention. *Personal Relationships* 12:447–463.
- Shackelford, T. K., G. J. LeBlanc, V. A. Weekes-Shackelford, A. L. Bleske-Rechek, H. A. Euler, and S. Hoier
2002 Psychological Adaptation to Human Sperm Competition. *Evolution and Human Behavior* 23:123–138.
- Shackelford, T. K., N. Pound, and A. T. Goetz
2005 Psychological and Physiological Adaptation to Human Sperm Competition. *Review of General Psychology* 9:228–248.
- Shackelford, T. K., N. Pound, A. T. Goetz, and C. W. LaMunyon
2005 Female Infidelity and Sperm Competition. In *The Handbook of Evolutionary Psychology*, D. M. Buss, ed. Pp. 372–393. New York: Wiley.
- Simmons, L. W., R. C. Firman, G. Rhodes, and M. Peters
2004 Human Sperm Competition: Testis Size, Sperm Production, and Rates of Extrapair Copulations. *Animal Behaviour* 68:297–302.

Smith, R. L.

1984 Human Sperm Competition. In *Sperm Competition and the Evolution of Animal Mating Systems*, R. L. Smith, ed. Pp. 601–660. New York: Academic Press.

Symons, D.

1979 *The Evolution of Human Sexuality*. New York: Oxford University Press.

Trivers, R. L.

1972 Parental Investment and Sexual Selection. In *Sexual Selection and the Descent of Man*, B. Campbell, ed., Pp. 139–179. London: Aldine.

Wilson, M., and M. Daly

1992 The Man Who Mistook His Wife for a Chattel. In *The Adapted Mind*, J. H. Barkow, L. Cosmides, and J. Tooby, eds. Pp. 289–322. New York: Oxford University Press.

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