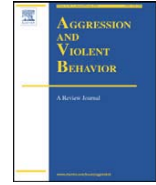




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Aggression and Violent Behavior



Women's avoidance of rape

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ABSTRACT

Females of many species have recurrently faced the adaptive problem of rape over the species' evolutionary history. In humans, rape of women by men has occurred throughout recorded history and across cultures, and exacts on women severe psychological, physical, and reproductive costs. Women therefore may have evolved psychological mechanisms that motivate rape avoidance behaviors. We provide an overview of recent theoretical and empirical research addressing women's rape avoidance psychology and behavior from an evolutionary perspective. This research indicates that women may possess evolved mechanisms that motivate rape avoidance. We conclude by highlighting several directions for research that may further clarify the design features of human female evolved mechanisms that motivate rape avoidance.

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More and more, scientists are examining human behavior through the lens of modern evolutionary theory. Evolutionary ideas have become more prominent in social sciences such as economics, political science, and perhaps especially in psychology (Durrant & Ward, 2011-this issue). There exist several evolutionary approaches to the analysis of human behavior. Here we take an evolutionary psychological perspective, and demonstrate its utility in developing novel hypotheses and promoting new areas of research.

Evolutionary psychologists often identify adaptations by first identifying recurrent adaptive problems faced by humans over evolutionary history. Knowledge of the likely adaptive problems is then used to infer the nature of current psychological mechanisms. Here we focus on the recurrent adaptive problem of rape of women by men. Rape by men of women has occurred across recorded history

(Broude & Greene, 1978; Rozée, 1993; Sanday, 1981) and is an unfortunate fact of life in modern society as well. Thus rape by men is likely to have been a recurrent adaptive problem for women over evolutionary history (Thornhill & Palmer, 2000). Rape results in many negative consequences for women and, therefore, women may have evolved psychological mechanisms designed to motivate rape avoidance behaviors. In this article, we review theory and research addressing women's rape avoidance from an evolutionary psychological perspective (for an overview, see Buss, 2004; Confer et al., 2010; Durrant & Ward, 2011-this issue). Evolutionary psychology is not a specific domain of psychology. Rather, evolutionary psychology offers a set of useful heuristic tools that can be used to generate novel and testable hypotheses across all domains of psychology. Evolutionary psychology rests on several premises (Buss, 2004).

First, evolution by natural selection is the only known process capable of producing complex functional systems such as the human brain. The complexity of human behavior can only be understood completely by taking into account both human evolutionary history and natural selection. Second, behavior depends on evolved psychological

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mechanisms. These are information-processing mechanisms housed in the brain that register and process specific information and generate as output specific behaviors, physiological activity, or input relayed to other psychological mechanisms. Third, an evolved psychological mechanism is functionally specialized as a solution to a specific adaptive problem. Adaptive problems are specific problems that recurrently affected reproductive success over evolutionary history. This third premise is often referred to as domain specificity. A fourth premise of evolutionary psychology is that human brains consist of many specific evolved psychological mechanisms that work together to produce behavior. The large number of evolved psychological mechanisms possessed by humans is what affords the behavioral variability seen in humans. Together with other tools and heuristics for generating hypotheses provided by modern evolutionary theory, these premises are used to generate evolutionary theories of psychology and behavior.

One such heuristic tool that informs the development of evolutionary psychological hypotheses is parental investment theory (Trivers, 1972). This theory extends the fundamental premises of natural and sexual selection and consists of two fundamental predictions. First, in sexually reproducing species, the sex that invests more in offspring (typically the female) will be more discriminating about mating. Second, the sex that invests less in offspring (typically the male) will be more intrasexually competitive for sexual access to the higher-investing sex. These predictions have been supported in research with numerous species, including humans. Human females, like the females of most biparental species, invest more in offspring, whereas males invest more in mating effort. These sex differences are greatest in short-term mating contexts (Buss, 1994a,b, 2004). Together, the premises and tools outlined above have been used to stimulate research across varied domains. Yet some scholars have demonstrated misunderstandings or misrepresentations of evolutionary psychological theory.

1. Misconceptions about evolutionary psychology

The study of rape and rape avoidance from an evolutionary psychological perspective has at times been extremely controversial (see e.g., Palmer & Thornhill, 2003a,b). Much of this controversy appears to be driven by misconceptions or misunderstandings of evolutionary theory. For example, some scholars believe that evolutionary psychological research is conducted to justify racism, sexism, or other undesirable “-isms.” For example, Tang-Martinez (1997, p. 116) describes a common feminist view that evolutionary psychology is “inherently misogynistic and provides a justification for the oppression of women.” The feminists to whom Tang-Martinez refers are committing a version of what is known as the naturalistic fallacy: the error of deriving what *ought* to be from what *is*. This error can be demonstrated clearly with an example: no reasonable person would argue that a scientist researching the causes of cancer is thereby justifying or promoting cancer. Yet, some people continue to argue that investigating rape from an evolutionary perspective justifies or legitimizes rape (e.g., Baron, 1985; Marshall & Barrett, 1990, cited in Thornhill & Palmer, 2000).

Related to the naturalistic fallacy is the false belief of genetic determinism: the idea that behavior is unalterable or unchangeable. This argument has been debunked numerous times. Biologist John Maynard Smith (1997) noted that genetic determinism is “an incorrect idea that is largely irrelevant, because it is not held by anyone, or at least not by any competent evolutionary biologist” (p. 524). No evolutionary psychologist would argue that because rape is produced by evolved mechanisms, it cannot be prevented or that its existence is a foregone conclusion. The goal of evolutionary psychology is to further our understanding of the phenomenon of interest, which in this case is rape. Researching rape from an evolutionary perspective does not justify or promote this heinous act. Whether evolutionary

psychological hypotheses about rape are correct, new perspectives often generate new insights into the target phenomenon. Indeed, researchers taking an evolutionary perspective have offered new insights into both rape and rape avoidance psychology.

2. Evolutionary theories of rape

Definitions of rape vary, and there are many types of rape. Here it is defined as the use by a man of force or threat of force to achieve penile–vaginal penetration of a woman without her consent (Kilpatrick, Edmunds, & Seymour, 1992; Thornhill & Palmer, 2000). Behavior analogous to rape appears to have been a recurrent adaptive problem for females across many animal species. Evolutionary theory predicts that sexual coercion and rape are likely to occur in any species in which males are more aggressive, more eager to mate, more sexually assertive, and less discriminating in choosing a mate (Thornhill & Palmer, 2000).

Sexual coercion and rape have been documented in many different species, including insects (Dunn, Crean, & Gilburn, 2002; Linder & Rice, 2005; Thornhill, 1980, 1981, 1987; Vahed, 2002), amphibians and reptiles (Olsson, 1995; Reyer, Frei, & Som, 1999; Shine, Langkilde, & Mason, 2003; Sztatecsny, Jehle, Burke, & Hödl, 2006), fish (Magurran, 2001; Plath, Parzefall, & Schlupp, 2003), birds (Gowaty & Buschhaus, 1998; McKinney, Derrickson, & Mineau, 1983; Pizzari & Birkhead, 2000), and primates (Robbins, 1999; Smuts & Smuts, 1993; Wrangham & Peterson, 1996). These studies indicate that rape has been a recurrent adaptive problem for many species.

Rape is a fact of life across all known human cultures (Broude & Greene, 1978; Rozée, 1993; Sanday, 1981). In Western samples, estimates of rape victimization are as high as 13% for women (Kilpatrick et al., 1992; Resnick, Kilpatrick, Dansky, Saunders, & Best, 1993). Rape is in fact likely to be more common than these estimates suggest, however, because rapes often go unreported (Kilpatrick et al., 1992).

Rape became a public and academic focus following the publication of Brownmiller's (1975) book, *Against our will: Men, women, and rape*. Brownmiller argued that rape is “a conscious process of intimidation by which *all men* keep *all women* in a state of fear” (p. 15, emphasis in original). Since then, feminist theories of rape have dominated the rape research literature. A prominent version of feminist theory contends that rape is the result of social traditions in which men have dominated political, economic, and other sources of power (Ellis, 1989).

Feminist theorists inspired by Brownmiller often interpret rape as a method by which men secure and maintain this power and dominance over women. Moreover, feminist theorists have argued explicitly that rape is not sexual in nature, and they often seem more focused on making ideological, rather than scientific, statements about human psychology and behavior (Thornhill & Palmer, 2000). These interpretations also ignore the existence of rape behaviors in many nonhuman species. Recently, researchers have begun to examine human rape from an evolutionary psychological perspective informed by comparative and other research.

Comparative evidence demonstrates that males of many species have evolved strategies to sexually coerce and rape females. Rape in humans must also reflect adaptations constructed over evolutionary time. Although numerous explanations have been offered to explain rape in humans (e.g. learning or enculturation, mental illness, personality differences, drug and alcohol use, and other factors) (Bergen & Bukovec, 2006; Brecklin & Ullman, 2001; Dean & Malamuth, 1997; Lalumière & Quinsey, 1996), these factors alone cannot explain the existence of such seemingly complex behavior. At best, these factors may increase the likelihood of rape occurring, but cannot explain the complex organized behavior seen in rape. Only two explanations are likely to be true: that rape is the product of specialized psychological mechanisms, or that it is a byproduct of mechanisms in the male mind selected to solve other adaptive problems, such as a mechanism to take needed resources by force, for example (Palmer & Thornhill, 2003a,b;

Thornhill & Palmer, 2000). While evolutionary approaches offer additional perspectives on the study of rape, there are weaknesses in current arguments. Particularly, there is no clear evidence supporting one explanation over another (Thornhill & Palmer, 2000). Debate continues on this topic.

Regardless of whether rape is the result of adaptation, or is a byproduct of other adaptations, women are likely to have evolved psychological mechanisms in response to the recurrent adaptive problem of rape. Next we review research in this area.

3. Women's rape avoidance

In humans, rape of women by men has occurred throughout recorded history and across cultures, and exacts on women severe psychological, physical, and reproductive costs (Thornhill & Palmer, 2000). There are several reasons why rape is traumatic for women. These include disrupting a woman's parental care, causing a woman's partner to abandon her, and causing a woman serious physical injury or death (Thornhill & Palmer, 2000). Women are sometimes killed after being raped (Shackelford, 2002a,b). Aside from death, perhaps the greatest cost to women who are raped is the circumvention of their mate choice (Wilson, Daly, & Scheib, 1997). This is because anything that circumvents women's choice in mating can severely jeopardize their reproductive success and ultimate fitness (Symons, 1979).

Researchers have speculated that several female traits or behaviors evolved to reduce the risks of being raped. Smuts (1992) argued that women form alliances with groups of men and other women for protection against would-be rapists. Similarly, Wilson and Mesnick (1997) proposed and found support for the bodyguard hypothesis: women's mate preferences for physically and socially dominant men may reflect anti-rape adaptation. Of course, women may form alliances or prefer dominant mates for reasons other than to avoid rape. Alliances offer protection from such dangers as assault or predation, and dominant mates may possess higher quality genes, for example. Finally, Davis and Gallup (2006) hypothesized that preeclampsia and spontaneous abortion may be adaptations that function to terminate pregnancies not in the woman's best reproductive interests, such as those resulting from rape.

Recent empirical research has tested the hypothesis that specific psychological mechanisms evolved to solve the recurrent adaptive problem of rape avoidance. Empirical evidence is accumulating that supports the hypothesis that women possess such mechanisms.

A linked series of studies conducted by Thornhill and Thornhill (1990a,b,c, 1991) demonstrates the power and utility of taking an evolutionary perspective in social science research. Thornhill and Thornhill argued that the psychological pain that women experience after being raped may be influenced by evolved mechanisms designed to focus women's attention on the circumstances of the rape, particularly the social circumstances that resulted in the rape. Thornhill and Thornhill argued that, like physical pain, psychological pain motivates individuals to attend to the circumstances that led to the pain and to avoid those circumstances in the future.

Thornhill and Thornhill explicitly used evolutionary theory to develop their arguments. They argued that victims of rape who have more to lose in terms of future reproductive success or fitness experience more psychological pain relative to women with less to lose in terms of future reproductive success (Thornhill & Thornhill, 1983, 1990a; Thornhill & Palmer, 2000). For example, reproductive-aged women are hypothesized to experience more psychological pain due to the greater risk of conception. Thornhill and Thornhill (1990a) provided support for this hypothesis, documenting that reproductive-aged women are more traumatized by rape than are post-reproductive aged women or pre-reproductive aged girls. This finding holds true even if force or violence is not used during commission of the act. They argued that the experience of greater psychological pain was due to the greater likelihood of pregnancy for women of this age range. Thornhill and Thornhill also

examined the effects of other variables including relationship status (1990a), relation to the offender (1990b), use of force and violence (1990c), and the nature of the sexual act (1991). Across the studies, the researchers found support for the general hypothesis that psychological pain following sexual assault was linked with potential fitness costs.

The relationship of psychological pain to use of force and violence (Thornhill & Thornhill, 1990c) provides a compelling example of the power and utility of an evolutionary perspective. For women in long-term relationships, force or violence during the sexual assault actually decreased their psychological pain following the assault. Women in a long-term relationship risk losing the vital support of their partner if they were to suspect an infidelity had occurred, rather than a rape. Physical signs of injury may actually decrease the likelihood of a man doing so, and paradoxically decrease the risks associated with rape for those women who are physically injured. It is difficult to imagine that a traditional social science model could predict or explain such findings. Such counter-intuitive results can be predicted and explained using the lens of evolutionary theory.

The research conducted by Thornhill and Thornhill focuses on the aftereffects of being raped and on the psychological pain that may motivate women to avoid the circumstances leading to the rape. Of course genetically and logically speaking, avoiding rape altogether is far more beneficial. Very little research, however, has been conducted to identify the specific behaviors women may deploy to avoid being raped. In one early study, Scheppele and Bart (1983) conducted interviews of women who had been raped, or who had been attacked and successfully avoided being raped. Some of these women described "rules of rape avoidance" (p. 64) and how they followed them, e.g. "I would never be alone on the street" and "I would watch what I wear" (p. 65). These qualitative data provide intriguing preliminary evidence for rape-avoidance adaptations in women. However, these researchers did not use an evolutionary perspective, limiting their ability to develop useful predictions related to women's reproductive status, for example.

Petralia and Gallup (2002) examined whether a woman's capacity to resist rape varies across the ovulatory cycle. Women in the fertile phase of their ovulatory cycle showed an increase in handgrip strength, but only when presented with a sexual coercion scenario. Women not in their fertile phase did not show an increase in handgrip strength. Furthermore, women in all other conditions, including women in the fertile phase who were presented with the neutral control scenario, showed a decrease in hand strength post-test. These findings may suggest that women possess specialized psychological mechanisms designed to motivate them to behave in ways that decrease the likelihood of being raped. Women who experience increased strength during their fertile phase may be better equipped to defend themselves from would-be rapists. The research by Petralia and Gallup provides evidence consistent suggesting that women have evolved mechanisms that motivate rape avoidance behaviors.

Chavanne and Gallup (1998) investigated the performance of risky behaviors by women in the fertile phase of their ovulatory cycles. A sample of women were asked where they were in their ovulatory cycles, and to indicate whether they had performed a range of behaviors in the previous 24 h. Behaviors were ranked by an independent sample of women in a previous study according to how likely performing the behaviors might result in a woman being sexually assaulted, with riskier behaviors given higher risk scores. Individuals' risky behavior was estimated by taking the summed composite score of all performed activities. Women in the fertile phase of their ovulatory cycle reported performing fewer behaviors representing a greater risk of being raped. There was no difference in the likelihood of performing low-risk behaviors between women in their fertile phase and women outside their fertile phase. This research has some methodological problems that prevent firm conclusions, however. First, the researchers used only one method (i.e., the forward-cycle method) to assess women's ovulatory status. Also, Chavanne and Gallup do not specify how the inventory of risky behaviors was developed, noting only that a

preliminary sample of women rated the riskiness of the behaviors. In addition, the dependent variable may be confounded by diversity of activity. For example, a woman who performed 10 non-risky behaviors (each scored as a “1” on the riskiness scale) could receive the same score as a woman who performed two high-risk behaviors (each scored as a “5” on the riskiness scale; see Bröder & Hohmann, 2003, for discussion). Despite these methodological issues, this research documented a significant decrease in performance of risky behaviors by women in the fertile phase of their ovulatory cycle. This evidence is consistent with the hypothesized function of rape-avoidance mechanisms, particularly when women are fertile.

Chavanne and Gallup's (1998) study was replicated by Bröder and Hohmann (2003) using a within-subjects design. Twenty-six women who did not use oral contraceptives were tested weekly for four successive weeks. The results indicated that women in the fertile phase of their ovulatory cycle selectively inhibit behaviors that would expose them to a higher risk of being raped, despite performing *more* non-risky behaviors. These results provide a conceptual replication of the results reported by Chavanne and Gallup. Women perform fewer risky behaviors when they are fertile, while still demonstrating a higher overall activity level (Morris & Udry, 1970) and even while engaging in more consensual sex (Morris & Udry, 1982). This selective behavior indicates that women may have evolved specialized psychological mechanisms designed to motivate behaviors that decrease the risk of being raped. Although this study addressed many of the issues in the Chavanne and Gallup research, there is still no indication of how risky behaviors were identified. This study also used the somewhat problematic forward and reverse-cycle counting methods for identifying the fertile phase of the ovulatory cycle, both of which depend on the potentially unreliable self-reports of participants (Bröder & Hohmann, 2003).

Garver-Apgar, Gangestad, and Simpson (2007) tested the hypothesis that women are more attuned to signs of a man's potential sexual coerciveness during the fertile phase and are more accurate at detecting sexually coercive men during the fertile phase. A sample of 169 normally-ovulating women watched short segments of videotaped interviews of men. The women were then asked to rate the men on several items that were summed to create an overall coerciveness rating. Average coerciveness ratings for each man were computed. Finally, women's ovulatory status was estimated using the reverse-cycle counting method. The results indicated that women in the fertile phase of their ovulatory cycle rated the men as more sexually coercive. This suggests that women at greater risk of conception may be more attuned to signs of male sexual coerciveness than women at lesser risk of conception. This may represent an evolved cognitive error management bias (see Haselton, Nettle, & Andrews, 2005, for an overview) toward identifying men as sexually coercive, which might serve to protect women from being raped.

This research provides more evidence that women may have evolved psychological mechanisms that motivate behaviors that guard against men's sexual coercion and rape. Note, however, that the participants viewed videos of strangers. Studies demonstrate that women have a greater fear of stranger rape than of being raped by someone they know (Thornhill & Thornhill, 1990b), which suggests that stranger rape was the greater adaptive problem. This is despite modern patterns of rape, which indicate that women are more likely to be raped by someone they know (Kilpatrick et al., 1992; Resnick et al., 1993). These results may reflect the greater potential costs associated with stranger rape, such as a decreased likelihood of investment by the genetic father of resulting offspring. Would similar results be found by testing women's coerciveness ratings of acquaintances or other familiar men? Future research is needed to explore these effects in greater detail. For example, researchers might ask women to rate the coerciveness of familiar faces of classmates or celebrities.

Navarrete, Fessler, Fleischmann, and Geyer (2009) examined shifts in outgroup bias associated with women's ovulatory status. The

researchers argued that outgroup males may have represented a greater risk of rape than ingroup males. They hypothesized that women would be particularly biased against outgroup members when ovulating and at the greatest risk of conception. Furthermore, they hypothesized that women would be especially biased against outgroup members when they perceived themselves to be at a high risk of sexual coercion. To test their predictions, the researchers first evaluated women's ovulatory status using the forward-counting method. They then collected reports of women's self-perceived vulnerability to coercion. Women's implicit and explicit attitudes toward outgroup members were measured using a variant of the Implicit Attitude Test, and a self-report scale, respectively. Race bias in mate attraction was assessed using difference scores between average attractiveness toward pictures of White targets and pictures of Black targets. Finally, women were asked to rate pictures of ingroup and outgroup members for characteristics related to their 'scariness'. Navarrete et al. found that bias in implicit attitudes, attractiveness ratings, and fear of an outgroup exemplar all closely tracked women's ovulatory status. There was a marginal relationship between ovulatory status and explicit race bias. But when all five dependent measures were composited together, the researchers demonstrated a robust link between this composite and ovulatory status. This research provides additional evidence that women possess evolved psychological mechanisms that motivate rape avoidance. Furthermore, it demonstrates the utility of evolutionary theory in generating and testing novel hypotheses.

In summary, a growing literature in evolutionary psychology provides evidence that women may have evolved mechanisms that motivate rape avoidance. These evolved psychological mechanisms may motivate women to assess the risk of being raped (e.g., the riskiness of walking in a dark parking lot alone) or the likelihood that a particular man may be sexually coercive. However, these previous studies of rape avoidance assessed different behaviors that were selected for assessment without an explicit rationale, making it difficult to compare specific results across the studies. There exists a need for a standard instrument to assess women's specific rape avoidance behaviors that has been shown to be broad in scope and empirically sound (McKibbin et al., 2009).

4. Measuring rape avoidance behavior

Using acts nominated through women's self-reports, McKibbin et al. (2009) constructed an inventory to assess women's rape avoidance behaviors. The Rape Avoidance Inventory (RAI) assesses performance of 69 behaviors, all specifically nominated by women as behaviors they performed to avoid being raped. Using principal component analysis, behaviors nominated by women were identified as belonging to one of four relatively independent components: Avoid Strange Men, Avoid Appearing Sexually Receptive, Avoid Being Alone, and Awareness of Surroundings/Defensive Preparedness.

The Avoid Strange Men component consists of behaviors which appear to motivate women to avoid unfamiliar men, and behaviors motivating women to avoid men who may represent a greater risk of being sexually coercive (e.g., “Avoid men who make me feel uncomfortable” and “Avoid drunk men”). The Avoid Appearing Sexually Receptive component consists of behaviors that may diminish a woman's physical or sexual attractiveness to a potential rapist (e.g., “Avoid wearing sexy clothing” and “Avoid making out with a man I have just met”). The Avoid Being Alone component consists of behaviors that appear to motivate a woman to stay around others (e.g., “When I go out, I stay with at least one other person that I know”). Finally, the Awareness of Surroundings/Defensive Preparedness component includes behaviors that appear to motivate a woman to be especially attentive to her surroundings (e.g., “Pay special attention to my surroundings”), as well as behaviors that enhance a woman's ability to thwart a would-be rapist (e.g., “Carry a knife”).

Interestingly, these components map closely onto a taxonomy of four “guidelines” for female defense against rape derived independently by Judson (2002, p. 121) following a review of cross-species research addressing primarily non-humans. These four guidelines are: “avoid groups of idle males,” “don’t attract attention,” “don’t leave home alone,” and “do carry weapons.” The conceptual confluence of these four components with those derived by Judson perhaps provides some evidence of the validity of this measure of human females’ defenses against rape.

Uniformly positive yet moderate correlations among scores on the total and component scales of the RAI provided additional evidence of the utility of the four-component nature of the RAI. These scores demonstrated that the four components were inter-related, yet still relatively distinct. Finally, McKibbin et al. (2009) demonstrated a consistent pattern of negative correlations between RAI scores and interest in and pursuit of short-term sex (which places women at increased risk of rape). Items on the RAI (which represent decreased risk of sexual assault or rape) were negatively correlated with a measure consisting of behaviors which represent a greater risk of sexual assault or rape. These findings provided initial evidence for the convergent and discriminative validity of the RAI as an assessment of women’s rape avoidance behaviors.

It could be argued that the RAI consists of a disproportionate number of items which relate to stranger rape rather than acquaintance rape. This is despite the fact that rapes are most often perpetrated by someone known to the victim (Greenfield et al., 1992). The items on the RAI were derived from behaviors nominated by women themselves, however. This, the authors suggest, indicates that while indeed less frequently occurring, stranger rape may elicit more fear in women. Relatedly, Thornhill and Thornhill (1990b) found that women who were raped by a stranger experienced more psychological pain than women raped by a man known to them. Items on the RAI may reflect the most relevant adaptive problems and associated fitness costs experienced by women over human evolutionary history (McKibbin et al., 2009). It is possible that women vary in their use of such behaviors in response to differences in potential costs associated with rape, or differences in the likelihood of victimization.

5. Individual differences in rape avoidance

As the work reviewed previously has demonstrated, women appear to possess evolved psychological mechanisms associated with rape avoidance. This is because ancestral women who responded to increased rape-related risk (such as at the time of ovulation) with more rape avoidance behaviors may have been more reproductively successful than women who did not. Guided by an evolutionary perspective, McKibbin, Shackelford, Miner, Bates, and Liddle (2011) identified several such variables that may influence women’s rape-related risk. Specifically, they predicted that individual differences in women’s attractiveness, relationship status, number of family members living nearby, and age would covary with women’s rape avoidance behaviors.

Cross-culturally, men more than women report a preference for physical attractiveness in a prospective romantic partner, because attractiveness in women more than in men is an indicator of fertility and expected future reproduction (e.g., Buss, 1989). Research suggests that would-be rapists also may prefer and target more attractive women, in order to maximize the probability of conception (Ghiglieri, 2000; Greenfield, 1997; Kilpatrick et al., 1992; McKibbin, Shackelford, Goetz, & Starratt, 2008; Thornhill & Palmer, 2000; Thornhill & Thornhill, 1983). Thus, more attractive women, relative to less attractive women, may perform more rape avoidance behaviors because of the higher probability they may be targeted by a rapist.

Mated women, as compared with unmated women, may incur additional costs associated with being raped (Thornhill, 1999; Thornhill & Palmer, 2000). Specifically, if a woman’s regular partner interprets the

rape as an infidelity, a mated woman risks losing her partner’s support and resources for herself and her offspring (Thornhill & Palmer, 2000; Thornhill & Thornhill, 1992). Thornhill and Thornhill (1990a,b,c) documented that mated women report more psychological pain than did unmated women following rape. Based on the findings of Thornhill and Thornhill, McKibbin et al. (2011) predicted that women in a relationship will report higher frequencies of rape avoidance behaviors than women not in a relationship.

Over evolutionary history, individuals with psychological mechanisms that motivated reciprocal exchange of resources and support with close family members are likely to have been more successful than individuals without such mechanisms (Hamilton, 1964). Close genetic relatives also may incur costs if a female relative is raped, such as decline in inclusive fitness associated with her injury, inability to contribute to the family, or care for her own offspring. Figueredo et al. (2001) found that the presence of adult male kin living nearby decreased the likelihood of a female relative being raped, perhaps because would-be rapists fear retaliation by the rape victim’s adult male kin. Individuals also may act in ways that more directly decrease the likelihood of a female relative being raped. Perilloux, Fleischmann, and Buss (2008) found that parents exerted more control over their daughters’ behavior than their sons’ behavior, particularly their mating behavior. Because a woman’s relatives may guard her directly or attempt to influence her rape-relevant behaviors, it was predicted that the number of women’s family members living in close proximity will correlate positively with the frequency with which women perform rape avoidance behaviors (McKibbin et al., 2011).

Analyses provided support for the prediction that women’s attractiveness would correlate positively with women’s reports of the frequency with which they performed rape avoidance behaviors. Because attractive women may be preferentially targeted by rapists (McKibbin et al., 2008; Thornhill & Palmer, 2000), these women appeared to perform more rape avoidance behaviors relative to less attractive women.

Women who reported being in a long-term committed relationship reported greater frequencies of total rape avoidance behaviors than women who did not report being in a committed, long-term relationship. This may be because mated women must manage the additional risk of losing their partner’s investment. Because mated women bear additional potential costs associated with being raped (Thornhill, 1996; Thornhill & Palmer, 2000; Thornhill & Thornhill, 1990a,b,c; Wilson & Mesnick, 1997), they appear to perform more rape avoidance behaviors relative to non-mated women.

Women’s reports of rape avoidance behaviors were also positively related to the number of male and female family members living close by. Individuals are able to manage their inclusive fitness interests by protecting female genetic relatives from being raped. Although men and women appeared to actively encourage rape avoidance behaviors in their female close relatives, men in particular seemed to encourage their female family members to behave in ways to avoid rape.

6. Conclusions and future directions

We have provided a broad overview of evolutionary psychological research on women’s rape avoidance behaviors and psychology. As the research reviewed above demonstrates, an evolutionary psychological perspective can be a powerful tool for generating new hypotheses and research designs in the social sciences. For example, it is unlikely that standard social science theoretical models would have generated the hypotheses that women’s risk avoidant behaviors (Chavanne & Gallup, 1998), impressions of men (Garver-Apgar et al., 2007), and even implicit attitudes toward outgroup members (Navarette et al., 2009) show significant shifts associated with shifts in ovulatory status and the concomitant conception risk. An evolutionary perspective allows researchers to eventually unify seemingly disparate explanations of behavior: proximate, functional, developmental, and historical (Durrant

& Ward, 2011-this issue). While standard social science models can and do provide areas of research and explanatory frameworks for a given phenomenon, only evolutionary science can provide a way to combine these separate frameworks.

Because of the severe costs associated with rape, it is likely that women have evolved psychological mechanisms that motivate rape avoidance behavior. However, because the risk of rape is not the same for every woman, these mechanisms may be sensitive to individual differences between women and within the same woman (e.g., at different phases during her ovulatory cycle) that influence their risk of being raped. A growing body of research suggests that this may be the case. Women do appear to possess evolved mechanisms that motivate rape avoidance behavior. Research also suggests that these evolved mechanisms are sensitive to individual differences in women and their environments.

Few researchers have investigated empirically women's strategies of rape avoidance, particularly from an evolutionary psychological perspective. With a greater understanding of the underlying psychological processes associated with women's rape avoidance, researchers and other professionals will be better positioned to help women avoid sexual assault and rape. For example, researchers and professionals may eventually be in a position to design effective, empirically-informed rape awareness or prevention programs.

An evolutionary perspective can be used to identify additional variables that may be relevant to women's rape avoidance behaviors. For example, there may be a relationship between the number of dependent children a mated woman has and the frequency or intensity of her performance of rape avoidance behaviors. A mated woman who has dependent children may perform more rape avoidance behaviors than a mated woman without dependent children because she risks losing her partner's support for herself as well as her offspring.

Previous studies have identified ovulatory shifts in women's behavior associated with increased risk of rape (Bröder & Hohmann, 2003; Chavanne & Gallup, 1998). Women might exhibit similar shifts in behaviors included in the Rape Avoidance Inventory (RAI; McKibbin et al., 2008). If the RAI provides a valid assessment of women's rape avoidance behavior, subsequent research should find that women show clear shifts in the behaviors indexed by the RAI when they are ovulating.

Women's self-reports of their rape avoidance behaviors may differ from the actual frequency with which they perform these behaviors. Or women may perform behaviors without consciously understanding why they do so. Future research might investigate whether observer-reported (e.g., reports by a same-sex best friend) frequencies of these behaviors differ from women's self-reports. Furthermore, no research has assessed the effectiveness of rape-avoidance behaviors. Future research should assess whether women who more frequently perform these behaviors (or particular components of these behaviors) in fact are less likely to report being raped.

The apparent bias toward fear of stranger rape may reflect, for example, a media bias toward reporting sensationalized accounts of stranger rape versus acquaintance rape or date rape. Future research should address whether stranger rape fears exist independently of such effects of media. For example, researchers might examine whether women in hunter-gatherer societies fear stranger rape more so than acquaintance rape.

Finally, as has been demonstrated in the research reviewed above, women appear to show shifts in behavior and cognition associated with the risk of rape as well as the associated fitness costs. Women appear to avoid risky behaviors and generally are more cautious. However, other researchers have demonstrated that women appear to unconsciously engage in appearance enhancement when they are ovulating (see e.g., Durante, Griskevicius, Hill, Perilloux, & Li, 2011; Durante, Li, & Haselton, 2010). For example, ovulating women appear to prefer wearing more revealing clothing. Because attractive women

may be especially targeted by would-be rapists (McKibbin et al., 2011) this appearance enhancement strategy apparently conflicts with a rape avoidance strategy. Similarly, some women appear to shift to a short-term mating strategy and are more likely to commit extra-pair copulations when they are ovulating (Gangestad, 2006). These findings need not be contradictory, however. Women may seek out short-term mating opportunities, or attempt to attract a long-term mate, while still behaving in ways to minimize the risk of rape by an undesired male. For some women, the risks associated with appearance enhancement or riskier mating strategies may be outweighed by the benefits by attracting a long-term mate, or gaining the opportunity to mate with a particularly attractive partner with good genes. Future research is needed to reconcile these seemingly opposing lines of research.

In conclusion, evolutionary psychology is a powerful heuristic tool that allows researchers to consider rape in a new light, generating new hypotheses and explanatory models. Researchers have hypothesized that women have evolved mechanisms that motivate behaviors to avoid being raped. A growing body of evidence supports this hypothesis (e.g., Bröder & Hohmann, 2003; Chavanne & Gallup, 1998; Petralia & Gallup, 2002). Researchers should continue to investigate the psychological mechanisms associated with women's rape avoidance behavior. Such information will not only inform scientific theory, but also may improve the lives of women around the world.

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