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The evolutionary psychology of violence

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This paper reviews theory and research on the evolutionary psychology of violence. First, I examine evidence suggesting that humans have experienced an evolutionary history of violence. Next, I discuss violence as a context-sensitive strategy that might have provided benefits to our ancestors under certain circumstances. I then focus on the two most common forms of violence that plague humans —violence over status contests and intimate partner violence— outlining psychological mechanisms involved in each. Finally, I suggest that greater progress will be made by shifting the study from contexts to mechanisms.

La psicología evolucionista de la violencia. Este artículo revisa la teoría y la investigación sobre la psicología evolucionista de la violencia. En primer lugar, se examinan las evidencias que sugieren que los seres humanos han experimentado una historia evolutiva de violencia. A continuación, se aborda la violencia como una estrategia sensible al contexto que podría haber producido beneficios a nuestros antepasados bajo determinadas circunstancias. Después nos centraremos en las dos formas más comunes de violencia que azotan a los seres humanos —la violencia durante disputas por estatus y la violencia de género— perfilando los mecanismos psicológicos implicados en ellas. Finalmente, se sugiere que se pueden derivar grandes progresos en este campo si se pasa de un estudio de los contextos a un estudio de los mecanismos.

Imagine that you could see the process of evolution by natural selection unfolding in front of you. Imagine that you could witness generations of individuals competing with one another over access to limited resources. What strategies and tactics might evolve? This experiment was realized by evolutionary robotics researchers in Switzerland. Floreano, Mitri, Magnenat, and Keller (2007) designed robots with tank-like tracks for mobility, an omindirectional camera to detect light, and a translucent ring encircling the body that could emit blue light. Their intention was to study the evolution of communication systems by observing how signals are produced and perceived, but the results revealed something more sinister.

The robots were released into a 9 m^2 arena that contained a food source and a poison source that emitted red light (though the two sources were discernable at close range). The robots gained one "performance unit" (a numerical value assigned by the researchers) when they encountered the food and lost one unit when they encountered the poison. Additionally, the robots were programmed with 30 "genes", software consisting of simple code that determined the robots' sensation, perception, and movement. In a trial (analogous to a generation), 10 robots were left to forage in the arena: wheeling around detecting food and poison, jockeying for position around food sources, and gaining and losing performance units. The genomes (i.e., programming codes) of the best performing robots were selected to form the next generation, and a little mutation (error in the programming code) and sexual-like recombination were added to simulate what happens in nature.

Floreano and his colleagues reported the resultant behavior of 100 colonies of 10 robots for 500 generations. In just a few dozen generations, the robots had evolved visual signals to alert others about the whereabouts of the food source. A subpopulation of the robots, however, evolved more antisocial tactics. Instead of emitting a blue light when food was detected, some emitted the blue light far away from the food, sending the other robots on a wild goose chase or baiting them to go near the poison. The researchers interpreted this behavior as a deceptive signaling strategy for decreasing competition over the food. Moreover, even among the cooperators, the researchers reported that some robots would push others away from the food. Deceptive signaling and shoving can be thought of as "behavioral" strategies and tactics that evolved in their experiment. The engineers constrained the robots' "morphological" evolution, but if allowed to evolve hardware, it is possible the robots could have evolved weaponry.

Although this nonbiological simulation of evolution should not be considered of equal import as other biological data, this unique research illustrates that selection can fashion mechanisms and tactics that are successful in their current environment but that might be judged to be ignoble. Although cooperation and prosocial behavior evolved in many populations of the robots, deception evolved as well. This result was not surprising to evolutionary scientists. Natural selection —the primary mechanism of evolution— simply favors alleles that provide

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higher reproductive success in the current environment. Because selection is indifferent to moral standards and principles, it may produce adaptations for survival and reproduction that are antisocial. Antisocial behavior is any aggressive, violent, criminal, or delinquent behavior that benefits an actor at the expense of others (e.g., Lalumière, Harris, Quinsey, & Rice, 2005). Antisocial behavior involves the infliction of costs on others, but this infliction can involve others directly (e.g., assault) or indirectly (e.g., theft). Aggression is a class of antisocial behaviors directed at another to cause physical or psychological harm and can be physical or verbal. Violence refers to aggressive behavior that involves the intentional use of physical force to cause harm, injury, or death to another. All violent behavior is aggressive, and all aggressive behavior is antisocial. All antisocial behavior, however, is not aggressive (e.g., burglary), and all aggressive behavior is not violent (e.g., verbal abuse).

The current paper describes some aspects of human nature that are judged (rightly so) to be detestable but are nevertheless a product of evolution. The primary aim of this paper is to understand what would have been the evolutionary benefits to our ancestors of some forms of violence, and a secondary effort is made to outline some of the information processing mechanisms involved. My goal is not to address all forms of violence and all contexts in which violence erupts; instead, I will focus on the two most common forms of violence that plague humans: violence over status contests and intimate partner violence. Furthermore, as violence is overwhelmingly used by males, I will focus almost exclusively on male violence.

For discussions on the evolutionary psychology of antisocial phenomena not considered here, see Tooby and Cosmides (1988) on warfare, Lalumière, Mishra, and Harris (2008) on psychopathy, Hawley (2006) on Machiavellianism, Walsh (2006) on criminology, Kanazawa (2008) on theft, Daly and Wilson (1988) on infanticide and parricide, Thornhill and Palmer (2004) on rape, Goetz & Shackelford (2006) on partner rape, Hawley (2003) on bullying, and Campbell (1999) on female aggression.

An evolutionary history of violence

Humans' violent past is evident in studies of archaeological remains, traditional societies, our primate cousins, and human anatomy. The hallmarks of our ancestral history of violence are literally written on our bones. Skeletal remains, unearthed from archaeological excavations of ancient human societies, provide direct evidence of injuries suffered by a violent transgressor. Paleontologists, archaeologists, and anthropologists have excavated human remains littered with lesions and fractures from spearheads, arrowheads, axes, and clubs (Keeley, 1996; Lambert, 2002; Milner, 1999; Walker, 2001). These weapons were not accidentally thrust into the bodies of our ancestors; someone likely put them there.

Modern-day traditional societies, such as those inhabited by hunter-gatherers, offer a glimpse at a life that would have been similar to that of our ancestors, and life in these traditional societies appears to be dangerous. Homicide rates in many of these societies dwarf even the most violent American cities (Chagnon, 1988, 1996; Hill & Hurtado, 1996; Knauft, 1987). For example, Chagnon (1996) has documented that 25% of all Yanomamö males suffer a violent death. The cross-cultural ubiquity of violence (even in non-Westernized cultures without access to media) suggests humans have had a violent past.

Comparative studies of our primate cousins have documented that chimpanzees strategically use violence and aggression to negotiate their social world too (Muller, Kahlenberg, Thompson, & Wrangham, 2007; Wrangham & Peterson, 1996). For example, males aggressively overcome female resistance in all species of great apes (Muller & Wrangham, 2009). Humans align with the vast majority of mammals, deploying violence and aggression in specific contexts.

Anatomical evidence also implicates violence and aggression in humans' history. Upper-body strength, relative to lower-body strength, was crucial for intrasexual combat. Accordingly, men have about 75% more muscle in their arms than women, and men have about 90% greater upper-body strength than women (Abe, Kearns, & Fukunaga, 2003; Bohannon, 1997; cited in Lassek & Gaulin, 2009). Moreover, Faurie and Raymond (2005) have presented an intriguing yet highly speculative hypothesis that the persistence of left-handedness in human populations is rooted in violent combat. Handedness is highly heritable and left-handedness is associated with fitness costs (e.g., southpaws are typically smaller and more vulnerable to immune system abnormalities and deficiencies), which begs the question of why the polymorphism of handedness exists. Recognizing that left-handedness is advantageous in combative and direct interactive sports (such as boxing, fencing, and tennis; Grouios et al., 2000; Raymond et al., 1996), Faurie and Raymond (2005) hypothesized and found that left-handers have a frequency-dependent advantage during hand-to-hand combat. The costs of left-handedness seem to be offset by the benefits associated with left-handedness during violent combat, an intriguing hypothesis that begs further investigation.

Alone, one line of evidence affords only the possibility that human history has been marked by violence, but taken together, the archaeological, cultural, comparative, and anatomical evidence tells a story of the violent prehistory of our species.

Evolution does not always equal adaptation

Although violence has been a natural strategy of humans (especially males), this does not imply that all forms of violence are adaptations that were selected for because they solved adaptive problems and contributed directly to reproductive success. This is not to say that violence is not the product of evolution. It is. Rather, some forms of violence that exist today might not have been directly selected for. Byproducts are also products of evolution, but are characteristics of a phenotype that are functionless and do not solve adaptive problems (Buss, Haselton, Shackelford, Bleske, & Wakefield, 1998; Symons, 1992). They are called byproducts because they are incidentally tied to or produced by other adaptations. Any honest discussion of human aggression must concede that evolution is responsible, but this concession does not suggest that all forms of human aggression are engendered by specialized evolved mechanisms that were directly selected for. For some forms of violence (e.g., stepparental infanticide), evidence is unanimous in suggesting that the behavior is not the product of specialized psychological adaptation. For other forms of violence (e.g., uxoricide or wife-killing) evidence and theory necessary to implicate specialized evolved psychological adaptation is sparse, and thus more research is needed before claims can be made about adaptive design. Thus, adaptive design is not required to parsimoniously explain the

pushing behavior. In reality, determining whether a particular behavior is generated by specialized adaptation or generated as a byproduct of other adaptations can be exceedingly difficult, but claims of adaptations typically are stated tentatively until the proposed mechanism has undergone rigorous hypothesis testing using cross-disciplinary frameworks to show evidence of special design (Schmitt & Pilcher, 2004).

Violence as a context-sensitive strategy

To say that violence has been a natural strategy of humans does not imply that humans deploy violence indiscriminately. Serial killers, sadists, psychopaths, and other full time perpetrators of violence do not typify our species. Their prevalence in human populations is miniscule (American Psychiatric Association, 1994; Hare, 1993), and they are better characterized as exceptions to the rule, representing the pathological ends of a normal distribution of traits.

Rather than the continuous or indiscriminate use across contexts, the use of violence is a context-sensitive strategy. Even within the first investigations of violence and aggression in non-human animals, biologists articulated the various adaptive problems that violence could solve and the different contexts in which it might be adaptive (e.g, Clutton-Brock & Parker, 1995; Lorenz, 1966; Moyer, 1969; Wilson, 1975). E.O. Wilson (1975), for example, identified eight functionally distinct types of aggression: territorial, dominance, sexual, parental disciplinary, weaning, moralistic, predatory, and antipredatory aggression. This tradition of specifying contexts in which violence was adaptive continues today when studying violence and aggression in humans (e.g., Buss & Shackelford, 1997a; Wilson & Daly, 1985). Speaking to human aggression, Buss and Shackelford (1997a) proposed seven adaptive problems our ancestors recurrently faced that might have been solved by aggression: co-opting the resources of others, defending against attack, inflicting costs on same-sex rivals, negotiating status and hierarchies, deterring rivals from future aggression, deterring mate from infidelity, and reducing resources expended on genetically unrelated children.

Evolved mechanisms associated with violent status contests

An evolutionary psychological analysis of violence and aggression, however, requires not only identifying contexts in which aggression might have been adaptive but also testing hypotheses about the computational mechanisms associated with violence. Little empirical work has been conducted to elucidate mechanisms associated with violence, but we can infer some components based on some studies of human behavior. Below, I review just three.

Wilson and Daly (1985) and others (e.g., Wolfgang, 1958) have documented that the majority of homicides occur between unrelated men over real or perceived threats to status. Coded as "trivial altercations" in criminological databases because the arguments often begin over something petty and insignificant, these altercations are better understood as provocations, or what Goffman (1967) referred to as "character contests", in which an individual challenges or undermines the status of another. Arguments escalate and violence erupts—especially among young, unemployed, or unmarried men—when neither party acquiesces so as not to lose status (Wilson & Daly, 1985). In modern environments containing firearms, some of these provocations of status end in homicide. Although our ancestors possessed lethal weaponry that could be brandished in the context of a status dispute, it is unlikely that the majority of these disputes would have had lethal outcomes. The individual's goal was not to eliminate his provocateur, but to maintain (or increase) his status and reputation. That is, maintaining status and reputation using non-lethal means would have had fitness benefits without invoking specialized mechanisms for homicide. Even in American societies with easy access to firearms, homicides are relatively rare products of confrontations. For example, in 2007, Detroit had the highest homicide rate in the United States with 46 homicides per 100,000 people (U.S. Department of Justice, 2008). Thus, a Detroiter's chance of being killed in 2007 was 0.00046%.

While Wilson and Daly's (1985) research on homicide and status competition does not implicate an evolved homicide psychology (nor did they claim that it did), it does implicate a psychology sensitive to status hierarchy and threats to status. Indeed, Wilson and Daly discussed the psychology associated with status hierarchy negotiation. Disputes between individuals with discrepancies in status rarely end in violence because lower status individuals rarely provoke higher status individuals and because higher status individuals can shrug off a challenge without suffering reputational damage. When the average person challenges the status of a political figure or professional athlete, for example, this provocation is usually ignored. If, however, a political figure speaks ill of another politician or if a professional athlete criticizes another athlete, this type of provocation is not easily overlooked. Indeed, Wilson and Daly (1985) suggested that when the two parties are status matched, the dispute escalates because each perceives that he is not getting the respect he deserves. The evolved psychological mechanisms associated with status hierarchy negotiation and status maintenance may lead to antisocial behavior when the perception of status-inappropriate behavior by each individual engenders a status protecting and promoting arms race that erupts in violence.

Another seminal paper by Wilson and Daly (1997) implicated additional contexts in which psychological mechanisms lead to violence. Analyzing the widely variable homicide rates among 77 Chicago neighborhoods, Wilson and Daly documented that the best predictor of homicide rates is the intensity of economic competition, as measured by income inequality. Neighborhoods with greater economic inequality —large differences between the Haves and Have-nots— had a significantly higher homicide rate than neighborhoods with less economic inequality. When fitness relevant resources are distributed unequally, those at the bottom of this distribution are more likely to adopt a risky strategy that involves violence. Here, implicated psychological mechanisms include a monitoring of and concern with resource distribution. "Sensitivity to inequality is an expected feature of a psyche that adjusts risk acceptance as we envision, because those at the bottom may be especially motivated to escalate their tactics of social competition when it is clear that some 'winners' are doing very well and when the expected payoffs from low risk tactics are poor" (Wilson & Daly, 1997, p. 1271).

Experimental research has also tested hypotheses regarding the underlying evolved psychology of violence. Griskevicius, Tybur, Gangestad, Perea, Shapiro and Kenrick (2009) manipulated status and mating motives to examine their effects on aggressive tendencies in men and women. Men who had read a scenario

involving status competition (i.e., competing for a promotion at work) were more likely to respond aggressively to a scenario in which a same-sex individual spills a drink on them and does not apologize. Moreover, men who read a scenario involving mating (i.e., going on a date with a highly desirable person of the opposite-sex) were also more likely to respond aggressively to the trivial insult, but only when observers were other men. When motivated to attract a mate, men dialed down their aggression in the presence of women. Women, however, showed a different pattern: status and mating motives did not increase women's direct aggression but did increase their indirect aggression, such as talking behind the perpetrator's back. Griskevicius et al.'s (2009) findings highlight the context-specificity of violence and aggression and suggest that mechanisms associated with the deployment of violence are not haphazard but instead process specific environmental information —motivational state (competing for status versus attracting a mate) and social information such as the sex of the audience— before activating violent behavior.

An abundance of theoretical work on the psychological architecture associated with violence over status competition has been produced, and we are now in a position to begin identifying the proximate mechanisms, some of which can be tentatively suggested. Wilson and Daly's (1985, 1997) and Griskevicius and colleagues' (2009) work, for example, suggests that an evolved psychology of violence includes, but is of course not limited to, systems that are sensitive to status hierarchies and status maintenance, systems that monitor and are concerned with resource distribution in local environments, systems that track motivational states, and systems that process relevant social information, such as the status and sex of the audience of the dispute.

Are there specialized mechanisms for intimate partner violence and homicide?

Clutton-Brock and Parker (1995) argued that across animal species aggression often functions as a form of punishment that deters the targeted individual from repeating a behavior that conflicts with the interests of the aggressor. Analyzing occurrences of aggression across social vertebrates, Clutton-Brock and Parker documented not only that use of aggression occurs in situations in which an individual's fitness (probability of survival and reproduction) is at risk, but also that the intensity of the aggression varies with the degree to which fitness is threatened. Thus, if Clutton-Brock and Parker's model of aggression to fitness threats is considered in the context of human intimate relationships, what is the fitness threat that is generating female-directed violence? Did ancestral women recurrently threaten ancestral men's fitness, acting as a selection pressure that generated mechanisms for intimate partner violence? Of course, in any discussion of partner violence from this perspective it is critical to emphasize that an evolutionary analysis of any trait does not excuse, condone, or justify it. The evolutionary sciences are descriptive, not prescriptive.

Cuckoldry was likely one of the most profound threats to fitness our male ancestors faced. Some of the costs associated with cuckoldry include misdirection of the male's time, effort, and recourses to rearing a rival's offspring, loss of time, effort, and resources the man spent attracting his partner, and reputational damage if such information becomes known to others (e.g., Wilson & Daly, 1992). Taking into consideration the sum of these fitness costs, it becomes clear how selection could have favored the evolution of strategies and tactics aimed at avoiding cuckoldry and decreasing paternity uncertainty. I begin by discussing a psychological adaptation that serves this function: sexual jealousy.

Jealousy is an emotion that is experienced when a valued relationship is threatened by a real or imagined rival and generates contextually contingent responses aimed at reducing or eliminating the threat. It functions to maintain relationships by motivating behaviors that deter rivals from poaching and that deter mates from infidelity or outright departure from the relationship (Buss, Larsen, Westen, & Semmelroth, 1992; Daly, Wilson, & Weghorst, 1982; Symons, 1979). Because ancestral men and women faced adaptive problems of retaining partners and maintaining relationships, modern men and women do not differ in the frequency or intensity of their jealousy (Shackelford, LeBlanc, & Drass, 2000; White, 1981). A sex difference, however, emerges when considering the two types of jealousy —emotional and sexual— and coincides with men's and women's differing adaptive problems regarding relationships (Buss, 2000; Symons, 1979). Ancestral women's challenge of securing paternal investment needed to raise offspring exerted a significant selection pressure for women to be more sensitive to and more distressed by cues associated with a partner's *emotional* infidelity. Ancestral men's challenge of paternity uncertainty, however, exerted a significant selection pressure for men to be more sensitive to and more distressed by cues associated with a partner's *sexual* infidelity. Over three dozen empirical studies have shown the sex difference in jealousy, documenting that men experience more jealousy and distress in response to a partner's sexual infidelity, whereas women experience more jealousy and distress in response to a partner's emotional infidelity. These data are corroborated by experimental data (e.g., Schützwohl & Koch, 2004), physiological data (Buss et al., 1992), patterns of relationship termination (Betzig, 1989; Shackelford Buss, & Bennett, 2002), and the behavioral output of jealousy (e.g., Buss & Shackelford, 1997b).

Sexual jealousy, by itself, cannot prevent cuckoldry. Emotions are designed to coordinate mechanisms and ultimately direct behavior (Cosmides & Tooby, 2000). One behavioral manifestation of sexual jealousy is intimate partner violence (IPV; Shackelford, Goetz, Buss, Euler, & Hoier, 2005). In line with Clutton-Brock and Parker's (1995) discussion of the function of punishment, I consider the possibility that men's IPV originally functioned to punish and deter female infidelity (see also, Goetz, Shackelford, Romero, Kaighobadi, & Miner, 2008).

Male sexual jealousy or male sexual proprietariness (Daly et al., 1982) is one of the most frequently cited causes of intimate partner violence, both physical and sexual (e.g., Buss, 2000; Daly & Wilson, 1988; Dobash & Dobash, 1979; Dutton, 1998; Frieze, 1983; Gage & Hutchinson, 2006). Moreover, suspicion or knowledge of infidelity reliably provokes violent behavior (Goetz & Shackelford, 2006, 2009; Kaighobadi, Starratt, Popp, & Shackelford, 2008; Starratt, Shackelford, Goetz, & McKibbin, 2009). Physical violence has been identified as a tactic used by men to restrict an intimate partner's behavior, especially her sexual behavior outside the intimate relationship (Daly & Wilson, 1988; Goetz & Steele, 2009; Wilson & Daly, 1996) and is best understood in the context of female infidelity. Together with risk assessment of a partner's sexual infidelity (e.g., Goetz & Causey,

2008), contextual factors —such as social and reputational costs, proximity of the partner's kin capable of retaliation, and economic dependency (Figueredo & McCloskey, 1993; Wilson & Daly, 1993)— are processed during decisions to inflict violence on a partner.

Occasionally, men's use of violence against their partner is lethal. Male sexual jealousy is a frequently cited cause of uxoricide (wife-killing) and intimate femicide across cultures (Daly & Wilson, 1988; Serran & Firestone, 2004). Throughout history, directing lethal violence at an intimate partner would have been extremely costly for the actor, but some researchers have considered whether, under certain conditions, the benefits could have outweighed the costs enough for selection to produce specialized psychology associated with intimate femicide. Two general hypotheses have been advanced: the byproduct hypothesis and the homicide adaptation hypothesis. According to Wilson and Daly (Daly & Wilson, 1988; Wilson & Daly, 1998; Wilson, Daly, & Daniele, 1995), killing an intimate partner is not the product of evolved psychological mechanisms, but is a byproduct of mechanisms selected for their nonlethal outcomes. This byproduct or slip-up hypothesis argues that men who kill their partners have "slipped up" in that their violence —which was intended to control their partner— inadvertently resulted in their partner's death.

Recognizing that many partner homicides are premeditated and not accidental, Buss and Duntley (1998, 2003; see also Buss, 2005) have suggested that many instances of lethal IPV result from evolved psychological mechanisms specifically designed to motivate killing a partner under certain conditions. Discovering a partner's sexual infidelity, Buss and Duntley argue, may be a special circumstance which might trigger specialized psychology in men. The homicide adaptation hypothesis does not argue that discovering a partner's infidelity invariantly leads to partner-killing, but that this situation activates evolved mechanisms associated with weighing the costs and benefits of homicide, and that under certain circumstances, partner-killing by men might be the designed outcome (Buss, 2005).

Wilson and Daly's (1998; Wilson, Johnson, & Daly, 1995) and Buss and Duntley's (1998, 2003) competing hypotheses have not yet been tested concurrently so that a single hypothesis remains that best accounts for the data. Given the many costs associated with intimate femicide —e.g., incurring the wrath of kin and local community, experiencing a significant decrease in mate value (e.g., Burkett & Kirkpatrick, 2006), depriving any children of maternal investment, and intensifying mating competition among males— the most parsimonious explanation for intimate femicide remains Wilson and Daly's (1998; Wilson, Daly, & Daniele, 1995) byproduct hypothesis. Future research, of course, is needed to concurrently test the adaptation and byproduct hypotheses.

Concluding remarks

Humans have had a violent past, we have a violent present, and our future will likely hold violence. Characterizing humans as a "violent species", however, is inaccurate and does nothing to advance our understanding of human nature. We are not attracted to violence nor do we deploy violence indiscriminately. Violence is a context-sensitive strategy, applied in predictable situations and environments. As evolutionary psychologists maintain that the mind is a collection of information-processing mechanisms that exist because they solved recurrent adaptive problems throughout our species' evolutionary history, research must shift from the identification of contexts to the identification of psychological mechanisms. Evolutionary psychologists studying aggression and violence should be aware of the social relevance of their work, making explicit any practical applications their work might have. Lastly, further understanding of human violence and its underlying mechanisms cannot be expected unless a distinction is made (and more importantly, tested) between adaptation and byproduct hypotheses.

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