AGE AND SEX DIFFERENCES IN AGGRESSION AMONG THE AKA FORAGERS OF THE CENTRAL AFRICAN REPUBLIC

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Abstract

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Aggression is often considered a maladaptive behavior, and is an important social problem cross-culturally. There are two primary theoretical arenas examining the origins of age and sex differences in aggression. Evolutionary theories assert that sexual selection has shaped the age and sex differences in physical (e.g., hitting) and indirect (e.g., gossiping) aggression, suggesting that males make use of physical aggression in resource competition and social dominance while females rely on less risky strategies of indirect aggression for the same purposes. Biosocial theory ties sex differences in aggression to the inculcation of sex roles, with social norms serving to reinforce these divergences via expected behaviors with punitive consequences for violations. The majority of previous work on aggression in small-scale societies has emphasized its absence, particularly among hunter-gatherers. This paper examines age and sex differences in physical and indirect aggression, and in cultural norms surrounding aggression, among the Aka forest foragers of the Central African Republic. Both peer-rankings and self-report data were collected from 98 Aka (children, adolescents, and adults) on physical and indirect aggression; additional data on anger, reputation, and

alliances were obtained from adults. A Likert scale was used to obtain measures of social norms, perpetration, and victimization. The results provide only mixed support for evolutionary theories on aggression. Although the expected sex-bias in hitting emerged among children and adolescents, this effect disappeared among adults. An adult female bias in gossiping emerged only when anger was added to the model, and no bias was found in children or adolescents. Our negative findings might be due to unmeasured social and cultural factors, such as high levels of relatedness, the role of women as disciplinarians, and reduced male testosterone due to high levels of paternal investment. As there is little research on hunter-gatherer aggression, it is currently unclear where the Aka fit on aggression measures among small-scale societies. However, these results indicate the importance of quantifying aggressive behaviors in order to clarify the effects of biology, environment, and culture in the development and evolution of aggression, and perhaps reveal current biases derived from the emphasis on Western populations in the literature.

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Dedication

This thesis is dedicated to my daughters,
Oriana and Natascha.

INTRODUCTION

Aggression is often considered a maladaptive behavior, and is an important social problem cross-culturally. Globally, violence causes 9.2 deaths per 100,000 a year and warfare causes an additional 3.9 deaths per 100,000 per year (WHO, 2002). In the U.S., although there has been a significant decline in violent crimes over the past 30 years, there are still 1.4 million victims annually (U.S. Department of Justice, 2005). Worldwide, spousal abuse is also a widespread problem. The WHO estimates that between 15% and 71% of women in relationships are physically or sexually abused by their partner (WHO, 2009).

The mortality rate associated with violence is comparable to rates due to major global health problems. HIV/AIDS, for instance, is responsible for 5.84 deaths per 100,000 across all nations in the WHO database, cancers affect 37.02 per 100,000, and respiratory infections cause 20.9 deaths per 100,000 (WHO, 2002).

There is a growing interest in using evolutionary theory to tackle the problems of aggression and violence. I will first discuss the most common types of aggression evidenced among human populations, as well as their intended goals, and then move on to evolutionary theories of physical and indirect aggression. Evolutionary theory posits that aggression is one adaptive solution to various problems typically faced by most animal species over their evolutionary history. Benefits of aggression can include obtaining the resources of others; self- or group-defense against attack; contest competition; negotiating status and power; deterring rivals from future aggression; preventing sexual infidelity; and reducing resource expenditure on unrelated children (Buss and Shackelford, 1997).

Because individuals face different problems during different points in the lifespan, and males and females face differing selection pressures, variation is expected in aggressive behaviors at different ages and between males and females. Previous research on aggression in humans focused primarily on male physical aggression, almost to the exclusion of females, who exhibit very little physical aggression in comparison (Archer 2004; Archer and Coyne 2005; Buss and Shackelford 1997; Crick and Grotpeter 1995; Eagly and Steffan 1986; Levinson 1989; Maccoby and Jacklin 1974). However, female competition is an important aspect of human behavior and as a result, indirect aggression, which includes gossiping and ostracism (common in both sexes), is gaining greater attention from researchers (Bjorkqvist et al. 1994; Cashdan 1998; Hess and Hagen 2002, 2006a, 2006b; Owens et al., 2000; Rucas et al., 2006). Other important factors facilitating aggression, such as emotional state (e.g., anger), reputation, and alliances, will also be described.

Although aggression is often seen as an evolved, adaptive strategy, an alternate but complementary interpretation, in humans at least, is that social roles influence expression of aggressive behaviors. As it has been demonstrated that male and female sex roles are only moderately varied between cultures, it is possible that these universal roles explain sex differences in physical aggression (Eagly and Wood 1999; Wood and Eagly 2002). I will therefore examine biosocial theories of aggression and their relationship to our evolved tendencies in aggressive behaviors. An important proximate mechanism facilitating or inhibiting aggression is social norms, and these too will be briefly discussed. Additionally, in order to contextualize aggression among small-scale societies, an overview of current research is provided.

Using an evolutionary framework, which I explicate below, I examine age trends and sex differences in both physical (hitting) and indirect (gossiping) aggression and cultural norms surrounding aggression among the Aka forest foragers of the Central African Republic. Among adults, the effects of anger, alliances, status, and exposure to the local farming village on peer-ratings of aggression are also investigated. The Aka are an excellent population for aggression research for two primary reasons: 1) the hunter-gatherer lifestyle characterized the vast majority of human history and represents the face-to-face society in which our innate tendencies towards aggression would have evolved; and 2) research on aggression among hunter-gatherers is extremely limited. This study tests evolutionary theories of aggression and seeks to fill an important gap in our understanding of aggression among hunter-gatherers.

AGGRESSION

According to Geen (2001:3), "[a]ggression is the delivery of an aversive stimulus from one person to another, with intent to harm and with an expectation of causing such harm." In humans, aggressive behaviors can be classified as physical or indirect (i.e. nonphysical).

Physical Aggression

Physical aggression is the use of force in a direct, hostile confrontation with the goal of harming another organism in order to reduce competition. Proximate motivations vary greatly and include restoring status, mate retention, and maintaining territory. Expression of physical aggression can be as mild as rough-housing or as intense as warfare.

Studies typically show that physical aggression peaks between two to three years of age and then decreases over childhood (Tremblay et al., 1999). However, longitudinal analyses indicate that there are ontogenetic differences: some individuals maintain steady levels of physical aggression throughout childhood, whereas others show a general trend towards decline (Tremblay, 2000; Vaillancourt et al., 2003). These studies also demonstrate a sex difference early in life, emergent among toddlers (Archer, in press; Archer and Cote, 2005; Tremblay et al., 1999). Several studies have additionally documented an increase in violent behavior among males between the ages of 20 and 30 (Archer, in press, 2004; Marcus, 2009; Tremblay 2000).

Indirect Aggression

Different researchers refer to non-physical aggression by different terms, including indirect (Lagerspetz et al., 1988), relational (Crick and Grotpeter, 1995), and social (Cairns et al., 1989) aggression. These terms describe somewhat different suites of behaviors, but all refer to forms of aggression, both covert and overt, outside of direct (physical) confrontation[1]. In general, indirect aggressive behaviors are non-physical means of aggression meant to manipulate social relationships to the benefit of the aggressor and cause psychological harm to the target, often through gossip and ostracism.

Though studies of developmental trajectories in indirect aggression are rare, evidence indicates that indirect aggression is used by both sexes throughout life (Vaillancourt, 2005:161 and references therein). Tomada and Schneider (1997) found boys rate higher on indirect aggression in their study of Italian children. It appears,

[1] We will use the term indirect aggression, after Archer and Coyne (2005), to refer to these non-physical aggressive behaviors as this was the phrase first coined by Lagerspetz et al. (1988) to describe this form of aggression.

however, that this is the more typical form of aggression for females (Archer, 2004, in press; Bjorkqvist et al., 1992; Campbell 1999; Crick and Grotpeter, 1995; Hess, 2006; Hess and Hagen, 2002, 2006a).

Indirect aggression requires greater interpersonal and cognitive skill than physical aggression; as a result, I would expect its use to increase across the lifespan. This is supported by research demonstrating that children transition from physical to indirect aggression as their social-cognitive skills develop and that girls are already skilled at indirect aggression by late childhood (Bjorkqvist et al., 1992). I would thus expect its use to peak in late adolescence/early adulthood when resource conflict and/or reproductive value (Campbell, 1999) is likely to be highest.

EVOLUTIONARY THEORIES OF AGGRESSION

Aggression has its origins in territorial defense, mate attraction and retention, and other forms of resource competition that could increase reproductive success (Archer, in press; Bowles, 2008; Buss and Shackelford 1997; Davies, 1978; Knauft, 1991; Van Schaik, 1983). Researchers have observed that across cultures males more frequently employ physical forms of aggression (Archer, 2004; Archer and Coyne, 2005; Bjorkqvist et al., 1994; Buss and Shackelford, 1997; Cashdan, 1998; Crick and Grotpeter, 1995; Eagly and Steffan, 1986; Hess and Hagen, 2002, 2006a, 2006b; Levinson, 1989; Maccoby and Jacklin, 1974). The sex differences predicted by evolutionary theory are derived from the physiological and psychological differences between males and females.

Men and women share vast similarities, yet each face unique reproductive obstacles. Men do not give birth and women do not face maternity uncertainty. Most importantly, females are obligate parental investors; their reproductive capacity is limited

by gestation and lactation. As a result, human females tend to prefer high-quality, high-investing mates and are consequently considered the "choosy" sex (Trivers, 1972). Since male reproductive success is limited primarily by the number of mating partners available to them, they generally seek out more mating opportunities while displaying varying levels of parental investment. Because males benefit by mating with multiple females, intrasexual competition increases, often resulting in aggressive behavior among men. This pattern is a widely accepted ethological principle and has been demonstrated from the simplest species to the most complex (McCall and Shields, 2008). The underlying assumption, derived from theories of sexual selection (Trivers, 1972), is that male competition for resources and mates often necessitates physical confrontation. It would therefore follow that since age coincides with mating effort, physical aggression will peak when males have reached their greatest size and strength (Archer, in press).

Sexual selection has resulted in males who are willing to compete physically against competitors for resources and status, with the ultimate goal of increased reproductive success. Increased competition can be expected particularly when the sex ratio is male-biased. Wiessner (2009) notes that the "youth bulge" experienced among the Enga of Papua New Guinea generated an increased frequency of violence as males engaged in higher rates of mating competition. Wrangham and Peterson summarize the rationale behind this: "Males have evolved to possess strong appetites for power because with extraordinary power males can achieve extraordinary reproduction" (1996:233).

Coalitions, alliances, and dominance hierarchies

Coalitions probably evolved, in part, to facilitate and maintain access to resources because coalitions can easily outcompete lone individuals. But group living also brings

competition for limited resources between group members, and these competitions directly influence reproductive variability. Chagnon (1988:985) notes that "…[as] many of life's resources are finite, conflicts of interest are inevitable because the nature of some of life's resources ensure that individuals can achieve certain goals only at the expense of other individuals." Group living thus frequently necessitates strategic aggression.

Archer (2001:267) and others (Hawley, 2007; Puckett et al., 2008; Salmivalli et al., 2000; Sippola et al., 2007; Vaillancourt and Hymel, 2006) suggest that "aggressive individuals may be socially skilled"; that is, those who employ strategic aggression (physical or indirect) may enjoy greater social, and ultimately reproductive, success. Frequent contest competition often leads to the establishment of stable dominance hierarchies, which subsequently dictate priority access to resources (Silk, 2009). Winners of confrontations consequently have a greater probability of obtaining higher status.

High status individuals have larger social networks, and these can greatly improve an individual's odds of survival and high reproductive success. Coalitions provide numerous advantages to members including access to information regarding social relationships and material resources, better access to food or mates, the ability to enforce norms via costly punishment or mediation, shared childcare, protection from harassment, improved territory acquisition and defense, and increased group solidarity (Buss and Shackelford, 1997; Davies, 1978, de Waal, 2009; Hess, 2006 and references therein; Hess and Hagen, 2002; Silk, 2009; Turchin, 2009). It thus seems probable that both male and female coalitions are derived from the benefits they confer – that is, coalitions improve the outcome of aggressive encounters and thus effectively increase access to contested resources.

Evolutionary approaches to indirect aggression

In contrast to physical aggression, which exhibits a male-bias that seems well explained by the sexual selection hypothesis, indirect aggression often exhibits a female-bias (or no bias). Several researchers have attempted to explain the apparent female bias in evolutionary terms, ranging from obligate investment to resource competition.

Campbell (1999) argues that because mothers are the obligate and primary investors in offspring – both during gestation and for several years following parturition – mothers' survival is of greater importance to offspring fitness than is fathers' survival (see also Sear and Mace, 2008). Females should then evolve to be more concerned with their own survival than males are. As a result, females take fewer physical risks, including physical aggression. This is evidenced by higher levels of fear among girls and women and the greater concern of females regarding their health. Campbell additionally asserts that females are less concerned with status, that this is reinforced by the near-universal patriarchy of human culture, and that these too are tied to lower rates of physical aggression. While males compete for rank within dominance hierarchies, as this is tied to resource access and thus reproductive success, the lower variance of female reproductive success limits their competition to times when resources which will improve offspring survival are scarce (such as nutrition or high quality mates) (Hrdy, 1981). As highly physically aggressive females are aberrant in human populations, there are additional social costs for women to direct confrontation. But because resource access does increase survival, females will compete; as physical aggression is of greater risk to females on multiple scales, they will rely on indirect aggression to obtain these necessary resources.

Archer's arguments on indirect aggression, while complementary to Campbell's, put greater emphasis on indirect aggression as an alternative strategy to physical aggression "that is likely to be more adaptive than direct confrontation under certain social conditions" (Archer and Coyne, 2005:220). These conditions include high costs to direct aggression, the skills to use indirect aggression, and the existence of social networks where the use of indirect aggression to manipulate social standing (either by exclusion or via reputational effects) is of benefit to the aggressor. This last condition is key as this has the result of effectively eliminating or reducing competition for resource access at a significantly lower cost than direct, physical aggression. In addition, indirect aggression can function among women to restrict extra-pair copulation by male mates by excluding competitors or at least lowering their status within the group. As reputation is central to resource access among both males and females, indirect aggression is used by both sexes but is more likely to be employed by females as a lower cost strategy. However, Archer and Coyne (2005:225) note that:

> [A]lthough there may be beneficial consequences in terms of manipulating the social position and status of competitors, which is reflected in the impact of aggression on victims, engaging in these forms of aggression may also entail costs. The more the hostile nature of the actions can be disguised, the more these costs are minimized, but when they become overt they may rebound on the aggressor, leading to losses in social reputation that were intended to be inflicted on others.

It is clear that while indirect aggression can be costly, the benefits for the aggressor can be great when employed strategically to manipulate reputation and improve resource access.

The work of Hess (2006; Hess and Hagen, 2002, 2006a, 2006b) furthers these arguments and expands upon them, putting less emphasis on physiological differences

and focusing more on female competition. As coalitions clearly improve resource access within groups (Hess and Hagen, 2002 and references therein), maintenance of a positive reputation is important to obtaining social and mating partners. However, as reputation is maintained by shared information, it is particularly vulnerable to manipulation by gossip. As a result, "[g]ossip - honest or deceptive - may be one strategy by which individuals compete for scarce resources by using information to damage their opponents' reputations and improve their own" (Hess and Hagen, 2002). Rucas et al.'s study (2006) on the relationship between intrasexual competition and reputational effects on perceptions of female attractiveness among the Tsimane of Bolivia provides additional evidence on this point: reputation is "…vulnerable to manipulation particularly because it is maintained, at least in part, through linguistic avenues. Positive and negative reports about the social and physical characteristics of others might be employed strategically to affect social relationships among fellow group members and, therefore, indirectly with the actor" (Rucas et al., 2006:42). Within groups, gossip is therefore an important strategy for acquiring information on potential coalitional partners who can increase resource access.

Not surprisingly, a word for gossip is found among almost every culture and it has been clearly demonstrated that gossip is important to social relationships (Dunbar 2004). In an examination of the Standard Cross-Cultural Sample, data on the importance of gossip within a society was available for 135 of the 186 societies coded. Only 35 of the 135 – less than 25% - rated gossip as not important (11%) or of low importance (14%). The remaining 100 cultures rated gossip as ranging from "important" to "very important" (Divale and Seda, 1999; Murdock and White, 1969). For gossip to be useful, however,

the ability to discern truth from manipulation is necessary. Hess and Hagen (2006b) found that humans have cognitive specialization towards that end. When reputation-relevant gossip is repeated by multiple, independent sources it is considered more believable; veracity decreases when the source is a known competitor of the subject (Hess and Hagen, 2006b).

Because they compete predominantly within groups and because female reputation is derived from more subtle qualities than males (e.g., fecundity or fidelity), indirect aggression can have greater effect on females than males (Bjorkqvist et al., 1994; Hess 2006; Hess and Hagen 2006a; Hess and Hagen 2002). Additionally, genetic evidence indicates the widespread practice of female exogamy (Seielstad et al., 1998), which allows males ample opportunities to create kin-based coalitions but requires females to seek alliances with non-related individuals[2]. Female exogamy presents a special challenge as a new female is a comparatively unknown quantity, a potential threat to existing alliances, and may also reduce access to already limited resources (Hess, 2006).

Indirect aggression is an alternative to physical aggression which is generally lower in cost and potentially higher in benefits (particularly among females) in the context of within-group competition. It functions to increase resource access via manipulation of reputation and improved contest competition without the inherent risks of physical confrontation. In those situations in which females face greater within-group

[2] It should be noted that humans often maintain contact with their kin and this, in fact, may be the drive behind exogamy as it may form the basis for intercommunity alliances (Hess 2006). Modern evidence of locality among hunter-gatherers appears to support this: 25% of hunter-gatherers live matrilocally and an additional 50% reside bilocally (Marlowe 2004; Meehan 2005b) thereby allowing access to a wider range of resources.

competition (e.g., in systems with female exogamy), they should tend towards more frequent use of indirect aggression.

The Role of Anger in Aggression

For both direct and indirect aggression, motivations may vary greatly and include restoring or improving status, generating coalitions, manipulating reputation, mate acquisition or retention, avoiding paternity uncertainty, and attainment and maintenance of territory. Regardless of the motivation, an important proximate mechanism in the expression of aggressive behaviors is anger. Anger is "an unpleasant or negative emotion that typically occurs in response to threat, disruption of ongoing behavior or deliberate and unjustified harm" (Campbell, 2006:239 and references therein) and can also serve as a signal of aggressive intent. Its evolutionary function is resolution of conflicts in favor of the angry individual who can "threaten to or actually withdraw benefits" and/or "threaten to or actually inflict costs" (Sell, 2009). Additionally, Elfenbein and Ambady's (2002) meta-analysis showed that anger is one of the universally recognized emotions, both within and between cultures, further indicating that anger is an adaptation to social interactions.

Sell (2009) argues that the evolved function of anger is to attempt to negotiate conflicts of interest in favor of the angry individual. Since both males and females are faced with conflicts, one would expect no sex differences in anger. Although some studies have shown sex difference in arousal to anger (Knight et al., 2002; Ramirez et al., 2002), no consistent sex biases in anger have emerged (Archer, in press).

SOCIO-DEVELOPMENTAL THEORIES OF AGGRESSION

Social role theory suggests that sex differences in physical aggression are not the result of sexual selection but are instead due to the inherent differences in sex roles among men and women - man as provider, woman as homemaker – which are socialized from birth (Eagly and Wood, 1999; Mead, 1935/1950, 1949; Parsons, 1951). Archer's summary of the biosocial reformulation of social role theory states that "recurrent forms of the division of labor based on sex arose from an interaction between the requirements of the social and physical environment and constraints imposed by the mammalian method of reproduction and sex differences in size and strength" (Archer, in press). Since certain tasks are more efficiently performed by one sex than the other, sex differences become typed and are inculcated to varying degrees across cultures and over the lifetime (Eagly and Wood, 1999; Ember 1973; Mead, 1935/1950, 1949; Parsons, 1951). Mead suggests that social conditioning is essential to these, as what is considered feminine in one culture may be a masculine trait in another, concluding that "…many, if not all, of the personality traits which we have called masculine or feminine are as lightly linked to sex as are the clothing, the manners, and the form of head-dress that a society at a given period assigns to either sex" (Mead, 1935/1950:190).

Because physical aggression is frequently tied to male sex roles, it is expected that men will evidence significantly higher rates than women. Conversely, as females are widely expected to inhibit aggressive responses, women's aggression will be mediated by female traits of "empathy, fear of retaliation, and guilt and anxiety associated with the consequences of aggression" (Archer, in press and references therein). Biosocial theory would thus propose that the cumulative effects of socially learned sex biases would lead

to an increase in aggression over the lifespan (depending on cultural norms) as aggressive traits are inculcated. This framework further suggests that "gender roles emerge from the productive work of the sexes" (Wood and Eagly, 2002:701; Mead 1935/1950) and that these sex-typed behaviors are maintained through inculcation of gender, the greater physical strength of males, and the obligate parenting of females (Parsons, 1951). As evidence that cultural sex roles are a stronger determinant than sexual selection in aggressive behavior, Eagly and Wood (1999) note that the United Nations indices demonstrate less intersexual variability in countries with greater gender equality. This account leaves aside not only a number of other cultural factors, but additionally does not address the consistent gender biases still demonstrated in these countries, albeit to a lesser extent (Archer, in press; Archer 2004; Buss and Shackelford 1997; Campbell, 1999).

While physical and indirect aggression serve distinct purposes among the sexes, indirect aggression has not received the same levels of attention that physical aggression has. Biosocial theorists have essentially ignored the importance of indirect aggression, especially by females, in the manipulation of social relationships. As a result, it is unclear how social role theory would explain the origins and inculcation of traits of indirect aggression.

The most probable explanation behind the origins of sex differences in aggression lies in sexual selection and its association with resource access. Biosocial role theorists assert that sexual selection is unlikely to have been a major factor in human evolution for two reasons: "(1) sexual selection operates 'primarily' in polygynous mating systems, where male competition is greatest; and (2) that other indications of sexual dimorphism in humans, such as size and canine teeth, are low compared to other primates" (Archer, in

press; Wood and Eagly, 2002). But if male strength, for example, is a factor leading to differentiation in sex roles, this would indicate an underlying sex-biased adaptation from which sex roles would emerge (i.e. sexual selection for mates who can gain greater territory or provide protection) in addition to being a component of universal sex roles. Hence, biosocial role theory is itself predicated on sexual selection.

Biosocial role theory and sexual selection theory are not contradictory, but they do have different emphases. While the reformulated biosocial theory posits that cultural expectations would be derived from our evolutionary history intersecting with environmental input, it fails to adequately address the selection processes evident behind this. Evolutionary theories on aggression do not dismiss the influence of cultural practices and social norms, as these can and often do affect expression of aggressive behaviors, but rather focuses on the evolutionary history of shared cross-cultural traits.

Social Norms

While we are unaware of our social roles at birth, it is clear that many behaviors are restrained or encouraged by cultural expectations (i.e., from interactions with our physical and social environments). Within a social system, our actions are shaped by exchanges among individuals and expected responses depending on status and social roles (Fehr and Fischbacher, 2004; Parsons, 1951). As a result, and with consistent environmental and social factors, behaviors tend towards certain regularities. Many of these learned social roles are transmitted from parent to child, but are also shaped by our interactions with other group members (Harris, 1998; Hewlett, 1991; Parsons, 1951).

Norms and normative beliefs tied to sex roles and age categories may be an important factor in expression of aggressive behaviors. Normative beliefs are “an

individual's own cognition about the acceptability or unacceptability of a behavior" and are frequently tied to prevailing social norms (Huesmann and Guerra, 1997:409). For instance, Harris (1995) found that "machismo" norms fostered higher rates of physical aggression and greater support of aggressive acts among Hispanics than their Anglo counterparts (but the male-bias in aggression was found among both populations). Nisbett and Cohen (1996) have demonstrated that cultures with "honor" norms tend to have high rates of physical aggression. This may support Eagly and Wood's notion that "[m]en's accommodation to roles with greater power and status produces more dominant behavior and women's accommodation to roles with lesser power and status produces more subordinate behavior" (Eagly and Wood, 1999:412)[3]. Among children, normative beliefs on aggression are significantly correlated with their observed levels of aggressive behaviors (Huessman and Guerra, 1997).

From an evolutionary perspective, it is challenging to explain the origins of social norms. However, their presence has been tied to the widespread cooperation evidenced in populations of unrelated humans, which (as noted above) has been tied to greater reproductive and social success. As interactions within a group will lead to desirable outcomes for some and negative ones for others, it has been suggested that norms arise to mediate these effects of competition and maintain social cohesion (Coleman, 1990 cited in Fehr and Fischbacher, 2004). To do so requires shared beliefs on appropriate sanctions for norm violations. Several studies using public goods (Prisoner's Dilemma) experiments have demonstrated that when the opportunity to punish defectors arises (even at a cost to oneself), cooperation among players increases and leads to an

[3] However, Daly and Wilson (2009) found that the "culture of honor" effect on violence disappeared when income disparities are controlled for indicating that, in this case, resource competition may in fact be underlying what on the surface appears to be an acculturated trait.

evolutionary stable strategy (Axelrod, 1984; Fehr and Fischbacher, 2004; Henrich et al., 2001). It is apparent that social norms lead to expected behaviors, exert strong control over interactions, and include sanctions for violators. This may be especially true among small-scale, face-to-face societies where normative behaviors can be more closely monitored.

AGGRESSION IN SMALL-SCALE SOCIETIES

Early descriptions of hunter-gatherers noted them as territorial and defensive, living "nasty, brutish, and short" existences, frequently suffering from starvation, and thinking little about the future (Kelly, 1995/2007). It was not until mid-twentieth century that this perception began to change. Following the 1966 "Man the Hunter" conference, Sahlin's (1968) concept of forager culture as the original affluent society took widespread and tenacious hold; hunter-gatherers were now often seen as "noble savages" living in harmony with nature and each other (Kelly, 1995/2007). More recently, the wide variation in hunter-gatherer lifestyles has been acknowledged and it clear that outside of a shared economic mode, distinct cultural and social differences exist (Kelly, 1995/2007; Kent, 1996; Schweitzer et al., 2000).

Research on aggression among foraging populations frequently emphasize its absence (Montagu, 1978). However, it should be noted that of the numerous studies which describe the nonviolence of foragers, most make extensive mention of the use of gossip, rough joking, and ridicule as means of maintaining group cohesiveness and social norms by leveling status among individuals (Draper, 1978; Hewlett, 1991; Levy, 1978; Thomas, 1958; Turnbull, 1965, 1978). These behaviors could easily be categorized as indirect aggression, and indeed in Western populations are classified as such.

In contrast to intragroup aggression, warfare is fairly well-studied among hunter-gatherers and small-scale societies[4], both past and present. Some assert that violence along the lines of warfare (and resultant homicide) is distinct from "normal" aggression (McCall and Shields, 2008). While the outcome of lethal aggression obviously differs significantly from that of non-lethal, it would appear that it is nonetheless derived from the same evolved strategies as interpersonal conflict (i.e., reducing competition for valued resources). Ember and Ember (1994) have demonstrated a close relationship between warfare and other forms of aggression, and they suggest that the presence of warfare may have the effect of lowering norms against other forms of violence (as parents may socialize their children for warriorhood, thereby legitimizing aggressive behavior); alternatively, parents may socialize children toward nonaggression (Montagu, 1978) and Kelly (2000) suggests that clear causality between socialization practices and aggression has yet to be established.

Many groups have social constructs (e.g., rough joking) in place to prevent escalation to violence, but physical aggression is nonetheless an important source of mortality for adults among many small-scale societies (of those where cause of death has been quantified), even those typically identified as non-aggressive (Table 1).

[4] While there are important distinctions between hunter-gatherers and small-scale societies (i.e., economy as many small-scale populations practice horticulture in addition to foraging), due to the lack of literature on aggression among these populations, they are being treated together for the purposes of this paper.

Table 1: *Percent of death by violence for adults among small-scale societies*

Society	Percent of deaths attributable to violence
Semai[5]	<1%
Waorani[6]	>60%
Yanomamo[7]	30%
Ache[8]	55%
Agta[6]	7%
Hiwi[6]	36%
Gebusi[9]	33%
!Kung /Ju'hoansi[10,11]	<1%
Hadza[8]	1%
Aka[12]	<1%

It is clear that there is a broad range in the effects of violence on mortality (spanning significantly less than 1% to well over half), but researchers note that there are no recorded cultures where aggression has not been evidenced to some extent (Montagu, 1978; Walker, 2001). Ember (1978) notes that 64% of hunter-gatherer societies experience warfare at least once every two years; for only 12% of the foragers included in her study was warfare rare. Warfare is comparatively uncommon among foragers

[5] Robarchek and Robarchek, 1998. Keeley (1996) notes that when the Semai were recruited by the British, they were "enthusiastic" as warriors (following the murder of some of their kinsmen). However, he further notes that they returned to their nonviolent lifestyle following demobilization, indicating strong social norms against violence.
[6] Robarchek and Robarchek, 1998
[7] Chagnon, 1988
[8] Hill et al., 2007, Griffin, 2000
[9] Knauft, 1987
[10] Among the !Kung and the Hadza, it has been suggested that higher rates of violence existed prior to colonial governance (Schapera, 1930, cited in Hill et al., 2007) and the low rates of death by violence today may be the result of interference by colonial governments (Hill et al., 2007).
[11] Knauft (1987:458) notes that the !Kung homicide rate [based off Lee (1979:398)] is between 29.3 and 41.9 per 100,000 per annum, less than 1%, but estimated to be almost three times the rate of homicide in the U.S. He additionally states that this rate is "six to eight times higher than the average reported among 'tribal' societies often considered to have relatively high degrees of social and interpersonal conflict." However, without the raw data, it is unclear from this estimate the percent of adult deaths directly attributable to violence.
[12] Hewlett et al., 1986. Keeley suggests that the forager-farmer relationship which typifies many Central African "pygmies" may exert a dampening effect on violent conflict (1996). As the Aka foragers maintain their unique cultural identity despite this interaction, it is unclear if he is correct in this assertion.

today, but it is unclear if the same was also true for prehistoric hunter-gatherers (Ember and Ember, 1997); indeed it appears likely that greater violence characterized at least our recent past (Gat, 1999; McCall and Shields, 2008; Walker, 2001). Additionally, low levels of warfare certainly do not preclude interpersonal conflict; while certain societies may be warless, this does not qualify them as "peaceful" (Kelly, 2000).

Wrangham et al. (2006) found that the median annual mortality among hunter-gatherers from intergroup aggression was 164 deaths per 100,000 (with a mean of 249, SD 273, n=12). The mortality rates due to violence were all less than 1%, but this study and those cited above do not include non-lethal or non-physical intragroup aggression. However, non-physical aggression is important to group cohesiveness. Draper (1978:31) notes that "[s]uch peoples [hunter-gatherers] typically rely on informal mechanisms of social control such as gossip, ridicule, sorcery, shunning, ostracism, and public debating which lead to the formation of consensus." Bowles further elaborates: "in groups adopting these so-called leveling practices [for social control], the tendency of altruistic members to be eliminated by natural or cultural selection is attenuated" (2008:327). Indirect aggression thus has a role to play in the maintenance of group cohesion. While more complex than simply killing off a competitor, this strategy also avoids the long-term costs of fatal aggression in group living. In small-scale societies, every adult member typically participates in resource acquisition to some extent and is a potentially important source of ecological knowledge. Exceptional violence is therefore unlikely to be tolerated and related kin would probably retaliate. As a result, non-lethal means of aggression are necessary to navigating sociality under the confines of limited resources.

Foragers inhabit a wide variety of environments and range broadly in their social norms regarding aggression (Barry et al., 1976). Few groups remain isolated from encroaching development, but the lifeways of hunter-gatherers still best approximate that of the majority of our evolutionary history. Yet most studies of aggression have focused on large-scale societies and it is unclear how foragers fit into the studies on aggression among Western populations. The study reported here adds to the limited data on aggression in small-scale societies, which is particularly important since settled, agricultural populations may present a biased picture of human aggression. Among societies with high rates of accumulated resources, it is probable that defense of these material goods is of great importance; as a result, elevated rates of aggressive behavior may be manifest (Knauft, 1991). Forager populations often lack storage, and defensible resources are limited to territory and mates. They therefore provide a broader picture of our evolved tendencies and sex-biases in aggression. Few studies examining non-lethal aggression among contemporary hunter-gatherers exist; to my knowledge, no previous studies on physical or indirect aggression among the Aka foragers have been made.

STUDY GOALS AND PREDICTIONS

Sex and Age Differences in Physical and Indirect Aggression

This study will examine developmental trends in gossiping and hitting among male and female Aka children, adolescents, and adults. I will additionally evaluate sex and age biases in both norms and peer-rankings on aggressive behaviors, as well as self-reported perpetration and victimization.

Physical Aggression

I expect that both sexes will express norms against physical aggression but that those of females will be stronger due to the greater inherent costs of aggression to females. I also predict that norms against physical aggression will be stronger among older adolescents and adults than among children and younger adolescents. Finally, I expect males to be peer-rated more highly than females on physical aggression, with a peak in late adolescence/early adulthood (around marrying age when reputation and status are of great importance).

Indirect Aggression

Both sexes are expected to express norms against indirect aggression, but females are again predicted to express stronger norms as gossip has been argued to be more harmful to female reputation than male reputation (e.g., Campbell 1999). I also expect that norms against indirect aggression will be stronger among older adolescents and adults than among children. Despite a prediction of stronger female norms against gossiping, peer-ratings of indirect aggression should show a female-bias, peaking in late adolescence/early adulthood (when manipulation of reputation is most effective in resource competition).

Effects of Alliances and Status on Aggression Rankings among Adults

Alliances and status have been previously demonstrated in Western societies to frequently correlate with higher peer-rankings on aggression (Archer, 2001; Puckett et al., 2008; Salmivalli et al., 2000; Vaillancourt and Hymel, 2006). Among the Aka, who are extreme egalitarians, I would expect the converse to be true. The following

hypotheses, while counter-intuitive to evolutionary theory, are derived from the Aka aversion to conflict. I expect that those rated as higher status will have lower ratings on aggression. I additionally predict that individuals ranked higher on alliances will also be rated lower on aggression. Among the Aka, experience, reputation, and persuasiveness are valued qualities in an individual (Berry et al., 1986). An individual who is well-respected and considered to be high status tends to influence others through his or her speech and fighting is considered one of the worst things an Aka can do. As alliance and status data was collected only for adults, children and adolescents will be excluded from this analysis.

Relationship between Village Proximity and Aggression Rankings

An Aka insult to another is to say that someone "dresses like a villager," which indicates a loss of their essential relationship to the forest. Yet a number of Aka, especially those closest to the village, have adopted some features of the Ngandu villagers' lifeways (house style, clothing) for various reasons. Based on my personal observations while staying in Bagandou, the Ngandu villagers clearly have more defensible resources, which correlate with an increase in aggression. Because of more aggressive tendencies among the Ngandu, and the greater assimilation of Aka individuals living in the camps closer to the village, I predict that those individuals situated physically farther from the village will be ranked lower on aggression measures. I also expect that those residing in camps closer to the village will have reduced social norms against aggression[13]. To assess the effects of proximity to the villagers on aggressive

[13] This study examines only "village" camps, which are those situated closer to Bagandou than "forest" camps (approximately 5-8 kilometers farther along the trail). Future research should collect comparative data from Aka living in forest camps.

behaviors, I will evaluate the relationship between distance (in meters) from the village to each campsite with peer-rankings on aggression. This study will include adults, adolescents, and children.

STUDY POPULATION

The estimated population of the Aka is between 15,000 and 30,000 (Bahuchet, 1985); accurate census, however, is challenging due to their frequent camp changes. The Aka are culturally and linguistically unique from other foragers across the Central African rainforest, but they do share some commonalities such as: "a strong identity with and preference for forest life"; an association with farmer populations; high mobility; and ritualization of elephant hunting (Hewlett, 1996a). Unlike other hunter-gatherers in the area, the Aka practice net hunting (instead of bow hunting) and the entire community, including children and adults of both sexes, are important participants in the hunt. The Aka are considered extremely egalitarian, without gender or intergenerational inequality, and maintain this ethic through prestige avoidance, rough joking, and demand sharing (Hewlett, 1991). While rough joking is not examined in detail in this study, this behavior could be considered a manifestation of non-physical aggression necessitated by group living in a decidedly variable environment. Demand sharing has been hypothesized to be one of the primary reasons the Aka have not adopted agriculture (although some do maintain small gardens), as relatives would come and request food at harvest time (Lupo, personal communication).

Five significant social units can be identified: the family, the camp, the clan, the band, and the regional community (Hewlett, 1991). In regards to the family, many men and women form lasting relationships resulting in several children (but marriage can be

dissolved with relative ease). Monogamy is prevalent, but polygyny is acceptable. Infertility is relatively unknown and Aka women average five live births (Bahuchet, 1999; Hewlett, 1991). The inter-birth interval is about 3.5 years but there are high rates (20%) of infant mortality (Hewlett, 1991). The leading causes of death at all ages are infectious and parasitic diseases, but children under age 15 are at greatest risk (Hewlett et al., 1986). The Aka are indulgent and affectionate parents, instilling autonomy and independence at a very early age, and demonstrate uniquely high levels of paternal investment (Hewlett, 1991).

An Aka camp averages between 20 and 35 individuals, or about 6 to 8 households, though the composition of these camps are subject to frequent changes (Bahuchet, 1990; Hewlett et al., 2000). Size tends to increase during dry season but this can be variable (Hewlett, 1991). My observations along the trail were made during the start of the rainy season; I found some mild variation from this, with camp sizes ranging from 11 to 55 people (mean=26). The clan is identified patrilineally, but this is relatively superficial and rarely remembered more than two to three generations back (Hewlett, 1991; Meehan, 2005a). Additionally, while descent is patrilineal, access to one's mother's trail is also available, so married Aka can freely make use of four distinct territories - the trails of the husband's mother and father as well as those of the wife's mother and father (Hewlett, 1996b).

Though there is a widespread sharing ethic maintained primarily through reputational effects, it is clear that not all foods are shared equally. Most desirable foods are eaten on the spot or hidden to be eaten later (Meehan, 2005a; Shannon, 1996). The Aka have extensive forest knowledge: they subsist primarily on 63 plant species, 20

insect types, honey from eight species of bees, and 28 species of game (Hewlett, 1991). (However, a large proportion of vegetable foods come from the farmers with whom they are associated in exchange for forest game). The band is composed of several clans that hunt and gather together in the same area over an extended period of time. The regional community is the exploration range of an individual and includes the areas where socialization occurs, social contacts are established, and where one meets his/her spouse (Hewlett et al., 1982).

The Aka have a mutually-dependent trading relationship with the Bantu farmers of the region (the Ngandu in this study area), yet retain their cultural independence. This relationship can be somewhat contentious; Bahuchet and Guillame (1982:194) note that the villager's opinion of the Aka is that they are devoid of culture and therefore "bound to be dominated." The farmers see themselves as essentially "agents of rural development," providing the Aka with an introduction to western clothes, medicines, and goods (Hewlett, 1996b).

Despite their perceptions of superiority, the farmers see the Aka as powerful hunters and connected to the spirits of the forest. They consider them to be great sharers, loving parents, and skilled in the supernatural (Hewlett, 1996b). The Aka, however, view the villagers as lazy, arrogant, brutal and coarse, comparable to forest animals in noise and aggressiveness (Hewlett, 1996b; Takeuchi, 2002). The Aka even have a hand motion to indicate their opinion of the Ngandu as chimp-like (Hewlett, 1996b). Somewhat conversely, the foragers and farmers have a fictive kin relationship of sorts; the Aka and Ngandu share clan names, indicating the tie between them (Hewlett, 1996b; Shannon, 1996:44-45). These bonds can be broken though, and the Aka can become a "free agent"

or retreat to the forest. Reasons for breaking away include: the feeling that they can get more money or products from new villagers; moving to a new area for new opportunities or services; or their village patron treats them poorly (Hewlett, 1996b). But this independence has the potential to move the Aka into a cash economy with which they are relatively unfamiliar and which can be exploitative (Bahuchet, 1999; Hewlett, 1996b).

While the Aka and Ngandu inhabit similar environments, the forest and village differ in several key ways. Aka camps are very intimate, with all entrances to huts facing the center of the camp. Conversely, Ngandu villages are much more private, with a minimum distance of 10 feet between the houses (Hewlett and Lamb, 2002); additionally, Ngandu homes have doors and windows that can be closed for even greater privacy (Meehan, 2005a). Although the Ngandu do practice demand sharing, which is an important social construct among the Aka, it is not nearly as extensive as among the Aka. As a result, there are significant differences in Ngandu material accumulations, resulting in higher rates of aggression: "households that accumulate more than others and do not share with neighboring families are prime targets of sorcery, which is believed to cause illness or death" (Hewlett and Lamb, 2002:249). The Ngandu also frequently attempt to draw attention to themselves and their attainments, whereas the Aka practice prestige avoidance (Hewlett, 1991).

The sample population for this study consists of 98 Aka individuals, solicited on an encounter basis, which comprised 40 adults (25 to 45 years old), 26 adolescents (12 to 18 years old), and 32 children (between 7 and 12 years old). As with many small-scale societies, Aka do not record birthdates; it is therefore difficult, and sometimes impossible, to determine ages with any certain accuracy. To estimate ages, two methods

were used. First, the indigenous age category of the participant was recorded, roughly 'child' (*mona*), 'adolescent'(*bokala* or *ngondo*), and 'adult'(*motopae* or *moatu*) (Hewlett, 1991). By definition, 'adolescents' are unmarried and 'adults' are married. After entering the study as unmarried adolescents, a small number of participants claimed to have recently gotten married. Among the Aka, marriages of young people typically entail bride service (a practice in which the young man moves to live with, and work for, his wife's family for a few years); in none of these cases was the putative husband performing bride service, so these 'marriages' were interpreted as more akin to serious dating relationships. Because 'adults' participated in another study restricted to reproductive age individuals, my 'adult' category excluded the elderly. For the second estimate of age, Barry Hewlett, based on 30 years of experience working with this population, estimated within-category ages to the nearest year, usually with input from the participant or one of the participant's parents, and/or other camp members (Table 2).

Table 2: *Basic demographic characteristics of the sample*.

	N	Male, Female	Age range	Mean age	SD (age)
Children	32	15, 17	5.5 -- 12	8.9	1.92
Adolescents	26	12, 14	12.5 -- 18	16.3	1.48
Adults	40	20, 20	25 -- 45	32.6	5.66

AGGRESSION AMONG THE AKA

While the Aka participants had little trouble recalling incidents of hitting or gossiping, it should be noted that these acts of aggression are not likely daily occurrences (particularly physical aggression). In fact, many Aka cited physical or verbal fighting as one of the worst things an individual can do to another (as it can lead to divisions within a

camp), along with not sharing, stealing (food or husbands/wives), and especially sorcery. These are also frequently the causes of hitting or gossiping.

Among children, causes of hitting include: no reason; being 'provoked'; because someone hit you; refusing to work; and dominance relationships. For instance, one child reported that his older brother hit him because he played with his brother's spear after being forbidden to touch it. Another girl reported being hit because she refused to be a particular boy's 'girlfriend.' The most frequently cited cause of gossiping (both in perpetration and victimization interviews) was food-related, i.e., eating someone else's food without asking or someone eating your food. Other reasons for gossip included hitting, not sharing (generally being selfish), or success in hunting (which can lead to suggestions of sorcery). Typically, children are hitting or gossiping about their friends, which frequently include their siblings.

Adolescents often referenced those reasons above in addition to those tied to budding sexual relationships. Like children, hitting sometimes occurs out of fun. One girl recounted how a certain boy will often try to knock the water she is carrying off her head. Another stated that she hit her younger sister because the younger girl ate her family's food and then blamed her. Both hitting and gossiping are sometimes tied to conflicts between two cliques of friends. Gossip leaned towards increasingly adult issues, although not sharing remained an important cause, and tended towards items tied to sexual relationships. One girl reported gossip victimization caused by her refusal of a marriage proposal; another cited an accusation that she was trying to steal her friend's husband. Sometimes these early relationships caused rifts among friends, with former allies gossiping about an individual due to their jealousy of her new boyfriend. These

more adult concerns also manifest in the adolescents perceptions of the worst thing one Aka could do to another, with not working and not resolving conflict being cited as significant problems.

Aka adults most often stated that they hit their wife or husband as a result of sexual jealousy. Several individuals noted that this often occurred at dances, where Aka from several trails come together at a single camp. These can be opportunities to meet new social partners but can also cause conflict in existing relationships. Other reasons for hitting were kin-related (i.e., one individual hit his brother-in-law when he was observed to hit his wife, the individual's sister, during bride service) or because someone had spread gossip. The most frequent cause of gossip is due to perceptions of not sharing enough with other camp members, an important social norm among the Aka. But making too much money, stealing, hitting others, retaliatory gossip, and acting too much like a villager are other significant sources of gossip.

METHODS

All 98 participants resided along the same trail, which is associated with the Bokoka cartier of the village of Bagandou, Central African Republic. Subjects, who would also serve as peer-raters, were solicited from a single trail to ensure familiarity with others involved in the study. There were two categories of participants: 1) participants who agreed to have their photograph taken and to subsequently be rated by peers on between three and six measures of aggression (n=98) and 2) a subset of these participants who also served as peer-raters (n=79). The latter group additionally provided self-reports on a five-point Likert scale of perpetration and victimization, as well as their interpretations of Aka social norms on aggressive behaviors.

Peer-ratings

The Aka are non-literate, so all questions were presented verbally by one of two Ngandu research assistants who translated questions from either French or English into DiAka (the Aka language). All peer-raters were interviewed in private, with the exception of some younger children, who were interviewed with their parents present. Parents were asked not to speak for their children, and typically followed this instruction. Photos were presented to peer-raters, one at a time, for ratings of the participants (peer-raters were in the same age category as the participant). The rater was asked if the person in the photo committed the specific aggressive act (e.g., hitting) more or less than most other Aka, providing a two-level rating (1, 0). Ratings were summed for each participant and then divided by the number of raters, resulting in a rating score between zero and one. The stack of photos was shuffled prior to each rating task, and raters were also asked to rate themselves.

Children and adolescents were asked to pile-sort individuals based on three aggressive behaviors: hitting, gossiping, and exclusion; only the results of hitting and gossiping will be presented here. Adults were asked about a wider range of physical and indirect aggressive behaviors, as well as anger, including: who is most prone to gossip; who hits most frequently; who is most liable to get angry; and who is most likely not to share when they are angry (sharing is a cultural fundamental among the Aka, and individuals often stated that the participant would share once the anger had passed); only gossip and hitting, and their relationship with anger, will be reported on here. Two additional pile-sorts were generated to examine alliances and status. To address these I asked: 1) “who is more likely to get help if s/he is involved in a conflict?” (in order to

discern probable alliances); and 2) “do people frequently respect and follow this person’s suggestions?” (as an index of status).

Likert Scales

For self-reports of victimization and perpetration of aggressive acts, a five-point Likert scale was implemented as follows. Participants were provided with five identical red plastic drinking straws. If the behavior in question (e.g,. hitting, gossiping) never happened, they were instructed to lay down one straw. If it happened very frequently, they were to lay down five straws. Laying down intermediate numbers of straws represented intermediate levels of the behavior. The same methodology was used to obtain social norms on aggressive behaviors, with one straw representing a belief that the behavior in question was “not bad at all” and five straws indicating that the behavior was “very bad.”

Semi-structured Interviews

At the end of each pile-sort, I enquired on the details of these acts to obtain data on gender constructs (i.e. who is more likely to gossip – males, females, or both equally?). Following the Likert scale questions, I asked who victimized the subject and against whom they perpetrated these acts (e.g., who hits you and why?) to better understand reasoning behind aggressive behavior. At the end of the interview, I asked what the worst thing an Aka could do to another to test if the aggressive acts examined fell along a relevant continuum of adverse behaviors.

Distance from Bagandou

Distances from the campsites to the local farming village were obtained using a hand-held Garmin eTrex GPS unit. An initial point was taken where the trailhead meets the village; subsequent points were taken at the entry path to each camp along the trail. The waypoint data was imported into ESRI's ArcGIS (version 9.2) software and exact measurements along the trail were obtained in meters (Table 3).

Table 3: *Distance between Aka campsites and Bagandou*

Camp	Distance to Village (in meters)
1	347
2	428
3	487
4	581
5	654
6	683
7	703
8	713
9	770
10	1,119
11	1,655
12	1,714

RESULTS

All analyses were conducted using Stata/IC 10.1 statistical package.

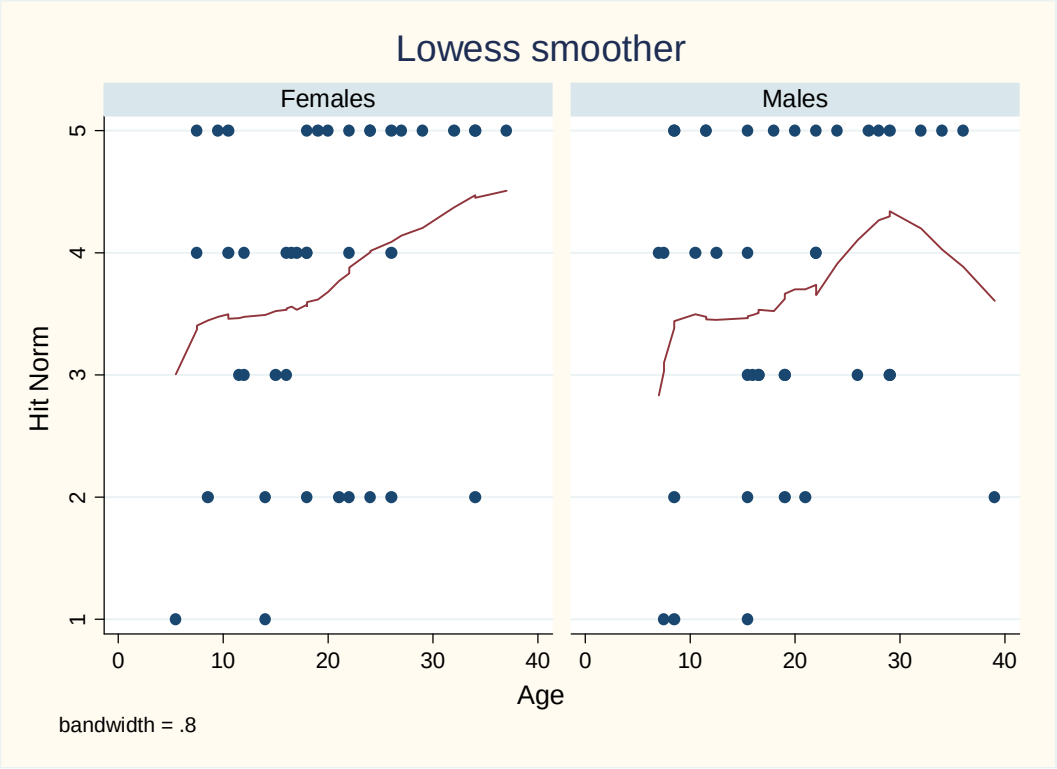
PHYSICAL AGGRESSION

Physical Aggression (Hitting) Norms by Sex

While both sexes did express strong norms against physical aggression, a two sample t-test showed no significant difference between the sexes (Females: n= 40, M =3.75, SD= 1.32; Males: n= 39, M= 3.67, SD= 1.32; t= 0.28, d= .064, p=.61).

Physical Aggression (Hitting) Norms by Age[14]

Figure 1: *Self-reported social norms against hitting (1=not bad; 5=very bad) vs. age. Lines fit by lowess regression.*



The expected increase in norms against physical aggression with age did emerge (r = .24, n = 79, p = 0.03); however, age explains very little of the variance in hit norms (less than 5%).

Physical Aggression (Hitting) Peer-Ratings by Age and Sex

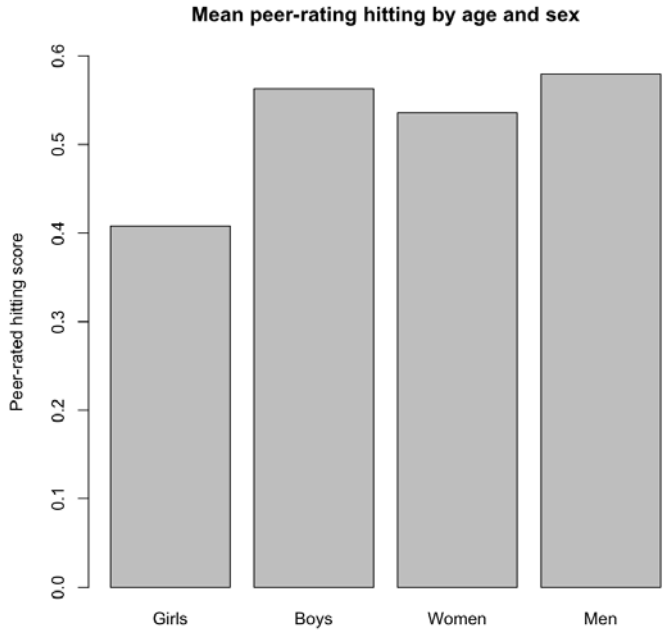
A two sample t-test shows that males are significantly more likely than females to be peer-ranked higher on hitting (Females: n= 51, M= 0.46, SD= 0.17; Males: n= 47, M= 0.57, SD= .16; t= -3.33, d= -0.68, p<.001).

[14] There is a six year gap between the oldest adolescents and the youngest adults; this was due to adult data being collected for a separate study.

However, when the analyses are performed separately in adult and non-adult subgroups (age >18, age <19), the sex-bias disappears among adults (Females: n= 20, M= 0.54, SD= 0.20; Males: n= 20, M= 0.58, SD= .22; t= -0.67, d= -0.21, p=.25) but among children and adolescents, there is a large effect of sex on hitting (Females: n= 31, M= 0.41, SD= 0.12; Males: n= 27, M= 0.56, SD= .11; t= -5.04, d= -1.35, p < .001).

Although age does predict an increase in hitting, it appears that this is due to an increase in hitting by women compared to girls (girls M= .41; women M= .54, d= -0.82, p< .001). There is no significant difference in hitting between boys and men (boys M= .56; men M= .58, p= .50). See Figure 2.

Figure 2: *Peer-rated hitting scores by age category and sex.*



Physical Aggression (Hitting) Peer-Ratings by Age

The expected peak in peer-ratings of hitting does appear to emerge in late adolescence/early adulthood. Interestingly, it seems to appear in both men and women.

Modeling the curve as a second-order polynomial found the quadratic term to be only marginally significant (see Table 4 and Figure 3).

Table 4: *Peer-rated hitting as a function of age and sex.*

Source	SS	df	MS	Number of obs = 98
Model	.43	3	.14	F(3, 94) = 5.26
Residual	2.54	94	.03	Prob > F = 0.002
Total	2.97	97	.03	R-squared = 0.14
				Adj R-squared = 0.12
				Root MSE = .16

hit_pr	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
age_corr	.02	.01	2.06	0.04	.00	.04
agsqcor	-.00	.00	-1.93	0.06	-.00	.00
sex	.11	.03	3.40	0.00	.05	.18
_cons	.29	.08	3.41	0.00	.12	.46

Figure 3: *Peer-ratings of hitting by age.*
Lines fit by lowess regression.

Physical Aggression (Hitting) Peer-Ratings vs. Anger

Among adults (age > 18) there was a strong correlation between peer-rated anger[15], and peer-rated hitting ($r = .70$, $n=40$, $p < .001$). When age was included in the model, it had a marginally negative impact on hitting (i.e., for a given level of anger, older adults had a slightly lower peer-rated hitting score). Sex was not significant in this model, and so was excluded (Table 5).

Table 5: *Peer-rated hitting as a function of peer-rated anger and age.*

Source	SS	df	MS		Number of obs = 40
Model	.91	2	.46		F(3, 94) = 21.08
Residual	.80	37	.02		Prob > F = 0.000
					R-squared = 0.53
					Adj R-squared = 0.51
Total	1.72	39	.04		Root MSE = .15

hit_pr	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
Anger_pr	.92	.17	5.57	0.00	.59	1.26
Age_corr	-.01	.00	-1.93	0.06	-.00	.00
_cons	.33	.16	2.10	0.04	.01	.64

INDIRECT AGGRESSION

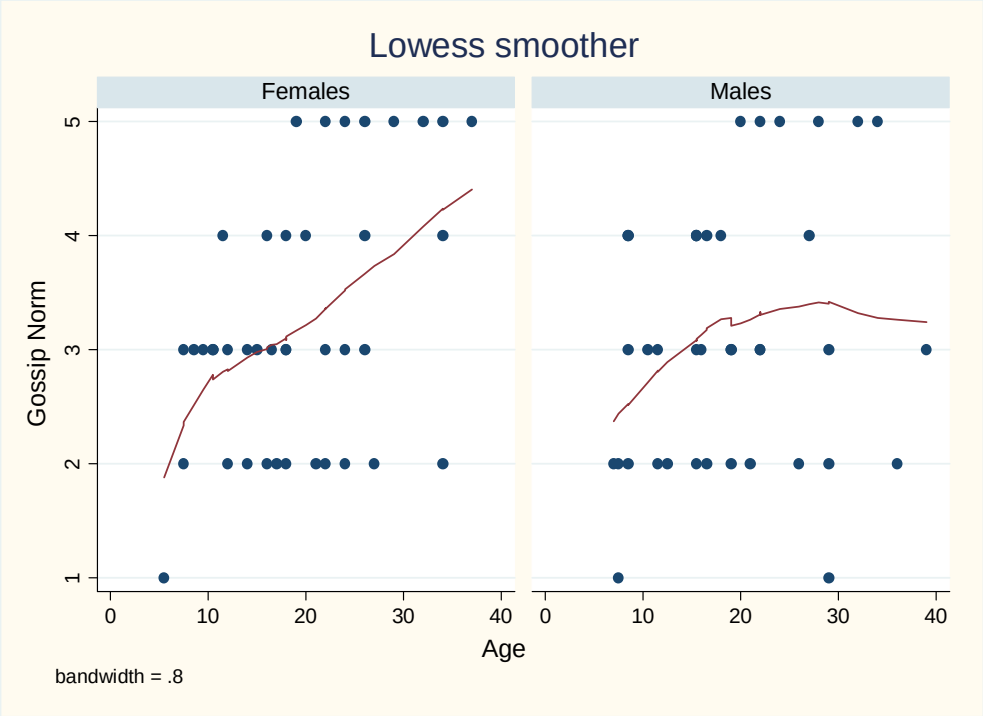
Indirect Aggression (Gossiping) Norms by Sex

Both sexes had fairly strong norms against gossiping and a two sample t-test showed no significant difference between the sexes in gossiping norms (Females: $n= 40$, $M= 3.23$, $SD= 1.14$; Males: $n= 39$, $M= 3.10$, $SD= 1.17$, $t= 0.47$, $p= .68$).

[15] Anger data was not collected for children or adolescents.

Indirect Aggression (Gossiping) Norms by Age

Figure 4: *Self-reported social norms against gossiping (1=not bad; 5=very bad) vs. age. Lines fit by lowess regression.*



The expected increase in norms against gossiping with age was significant (r= .35, n= 79, p= .002). Age explains approximately 11% of the variance in norms against gossiping.

Indirect Aggression (Gossiping) Peer-rankings by Sex

A two sample t-test showed no significant difference between the sexes on peer-rankings of gossiping when considered across the lifespan (Females: n= 51, M= 0.50, SD= 0.14; Males: n= 47, M= 0.50, SD= 0.11; t= -0.09, p=.47).

Indirect Aggression (Gossiping) Peer-rankings by Age

The expected bias among older adolescents/adults in peer-rankings of gossiping did not emerge. The lowess plots in Figure 5, however, hint at an increase in gossiping among older adult women, especially compared to older adult men. I therefore tested a model of peer-rated gossiping as a function of both age and sex and their interaction. In this model, age was now a significant positive predictor of gossiping, and sex and its interaction with age were marginally significant (Table 6). This model accounted for very little variance in gossiping, however (1.8%).

Table 6: *Peer-rated gossiping as a function of age, sex, and an age-sex interaction term.*

Source	SS	df	MS		Number of obs = 98
Model	.07	3	.02		F(3, 94) = 1.61
Residual	1.37	94	.01		Prob > F = 0.19
Total	1.44	97	.01		R-squared = 0.05
					Adj R-squared = 0.02
					Root MSE = .12

gossip_1	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
age_corr	.00	.00	2.13	0.04	.00	.01
sex	.10	.06	1.71	0.09	-.02	.21
age*sex	-.01	.00	-1.85	0.07	-.01	.00
_cons	.42	.04	10.49	0.00	.34	.50

One problem might be that sex is interacting, not with age, but with a nonlinear function of age. I therefore tested a similar model in which sex interacted with age^2 (Table 7). In this model, the interaction term is indeed significant, but again, the model accounts for little variance in gossiping (1.7%).

Table 7: *Peer-rated gossiping as a function of age, age^2, sex, and an age^2-sex interaction term.*

Source	SS	df	MS		
Model	.09	4	.02	Number of obs	= 98
Residual	1.36	93	.01	F(4, 93)	= 1.46
Total	1.44	97	.01	Prob > F	= 0.22
				R-squared	= 0.06
				Adj R-squared	= 0.02
				Root MSE	= .12

gossip_1	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
age_corr	-.00	.01	-0.30	0.78	-.02	.01
agesq	.00	.00	0.97	0.34	-.00	.00
sex	.06	.04	1.59	0.12	-.01	.13
agesqsex	-.00	.00	-2.05	0.04	-.00	-4.22e-06
_cons	.47	.06	7.43	0.00	.34	.59

Figure 5: *Peer-rankings of gossiping by age. Lines fit by lowess regression.*

There is no significant sex-difference in peer-ratings of gossiping among adults and non-adults. However, when anger is entered into the model, a significant ($p < .001$) female-bias among adults does emerge; anger and sex account for nearly 60% of the variance in gossiping (Table 8). For any given level of anger, women are gossiping more than men.

Table 8: *Peer-ratings of gossip as a function of sex and peer-rated anger.*

Source	SS	df	MS	Number of obs = 40
Model	.43	2	.26	F(2, 37) = 28.70
Residual	.28	37	.01	Prob > F = 0.000
				R-squared = 0.61
				Adj R-squared = 0.59
Total	.71	39	.02	Root MSE = .09

gossip_1	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
sex	-.08	.03	-2.69	0.01	-.13	-.02
anger_pr	.72	.09	7.48	0.000	.53	.92
_cons	.20	.05	4.23	0.000	.11	.30

STATUS/ALLIANCES AND PEER-RATINGS OF AGGRESSION (HITTING AND GOSSIPING)

Peer-rankings of status and alliances have no significant effect on peer-rankings of aggression (hitting or gossiping). Anger, age, and sex do not improve the model. Status and alliances, however, are significantly correlated (n= 40, r= .36, p= .02). When this relationship is examined by sex, it is significant for males (n= 20, r= .46, p= .05), but not for females (p= .26). Peer-rankings of anger slightly improve the model, with those rated lower on anger having higher status (Table9; p= .01, adjusted R-squared= 23%).

Table 9: *Peer-rated status as a function of sex, peer-ratings of alliance, and peer-ratings of anger.*

Source	SS	df	MS	Number of obs = 40
Model	.36	3	.12	F(3, 36) = 4.98
Residual	.86	36	.02	Prob > F = 0.01
Total	1.22	39	.03	R-squared = 0.29
				Adj R-squared = 0.23
				Root MSE = .15

status_p	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
Sex	.12	.05	2.45	0.02	.02	.22
alliance	.47	.20	2.29	0.03	.05	.88
anger_pr	-.34	.17	-1.98	0.06	-.70	.01
_cons	.35	.16	2.20	0.03	.03	.66

DISTANCE TO BAGANDOU AND PEER-RATINGS OF AGGRESSION (HITTING AND GOSSIPING)

Peer-rankings on hitting and gossiping were not significantly related to distance from the village; in fact, the camp situated closest to the village had the lowest summed peer-rankings on both measures of aggression. Age and sex do not improve the model. Norms were also uncorrelated with proximity to the village. Tests not reported.

DISCUSSION

Physical Aggression

Contrary to expectations, the Aka displayed no sex bias in hitting norms. Although I predicted that females would show a stronger bias, it is not surprising that both sexes express strong norms against hitting since the contributions and cooperation of all adult members are important to survival. Norms were stronger among older

adolescents and adults, which is expected from both evolutionary theory (as this population experiences increasing mate competition or mating conflict) and socio-developmental theory (as social norms are increasingly inculcated over the lifespan).

Peer-ratings showed males were significantly more physically aggressive; however, this sex difference disappeared when the analysis was limited to adults only. Among adults, the female peer-ratings on hitting slightly increase compared to children and adolescents, whereas adult male ratings remain similar to children and adolescents. One possible reason for the increase may be that mothers are more generally considered to be the disciplinarians in Aka culture; Hewlett's work (1991) indicates that mothers report having hit their child twice as frequently as fathers. He further notes that "[m]others are more likely to get angry at children, in part, because mothers are more likely than fathers to engage in multiple tasks in camp and are in greater need of assistance" (Hewlett 1991:113). As there are no punitive consequences to ignoring a parental request, mothers are left with little recourse besides anger and, possibly, gossip.

There are two other potential reasons why the expected male bias in hitting did not emerge. The first is that male physical aggression is typically tied to mating effort. As the age category of 'adult' among the Aka implicitly entails marriage, mating effort should be decreased among 'adult' males with a subsequent reduction in physical aggression. The second potential reason is the Aka emphasis on paternal investment. Because the Aka environment is highly variable (infant mortality is close to 20%), high levels of paternal investment, i.e. parenting effort, greatly improve infant survivorship. The Aka also highly value the father-child relationship and fathers spend extensive amounts of time with their offspring, close to half their day (Hewlett, 1991). Increased

emphasis on paternal investment may result in decreased physical competition for multiple mates, as there is typically a tradeoff between parenting effort and mating effort. Additionally, parenting effort has been linked to decreased testosterone in males (Archer, in press; Gray et al., 2002, 2006). Although high testosterone levels are not antecedent to aggression, they are correlated with higher rates of arousal to anger and greater risk taking (Archer, in press; Cashdan, 2003). Thus the reduction in levels of physical aggression in Aka men may be due to the extremely high rates of paternal investment evidenced in this society. Testosterone was not tested in this study and future research should examine this potential confound.

Indirect Aggression

The expected female bias in norms against gossiping did not emerge. While reputation is important to both males and females, this is somewhat surprising as female reputation is arguably more subject to indirect aggression than male aggression. Norms against gossip were stronger among older adolescents and adults but the effect was not particularly large; age accounted for only 11% of the variance in norms. This too is expected from either evolutionary or biosocial aggression theory. Females were not peer-ranked higher than males on gossiping, and the expected peak in peer-ratings among older adolescents and adults did not emerge. When age categories (adults and non-adults) were examined separately, however, sex and anger were significant predictors of peer-rankings of adults on gossiping and account for well over half the variance among females.

It is unclear why the female-bias in gossiping did not emerge in the older portion of the adolescent population. Aka females typically first marry at the age of 18, and

many of my participants were in "dating" relationships. Several made mention of the problem of sexual jealousy, further indicating that this bias should have emerged. It is possible that anger is an important mediator of aggression among adolescents as well as adults; future research among children and adolescents should include this measure. An additional confound may be the intimate nature of the Aka community. Adolescent females (often sisters and cousins) in each camp have their own huts, typically placed immediately adjacent to each other. This setting and lifelong knowledge of one another may reduce the need for high levels of gossip, whereas adult women face exogamy and comparatively unknown females.

Status/Alliances and Aggression ratings

Status and alliances were unrelated to peer-rankings of physical and indirect aggression. While it was not expected that highly aggressively individuals would be ranked higher than others on status and alliances, it is surprising that a negative relationship did not emerge given the Aka emphasis on egalitarianism; however, in alignment with my expectations, anger is negatively associated with status. Status and alliances are positively correlated among males; this may be due to the fact that the few status positions which exist among the Aka are typically held by males.

Distance to Bagandou and Peer-ratings of Aggression

As the Aka have lived in proximity to the Ngandu villagers for hundreds of years without losing their cultural autonomy, it is not too surprising that proximity to the village had no bearing on peer-ratings of aggression or social norms surrounding aggressive behavior despite the greater assimilation of Aka in the camps closest to

Bagandou. Additionally, the situation of a camp is not fixed. Those currently closest to the village may later be living farther along the trail. This mobility is a potential confound to our hypothesis. However, some Aka choose to remain deeper in the forest for long periods of time. As forest camps were not included in this analysis, future research should reexamine the relationship between aggression norms, peer-ratings, and proximity to the village among Aka living in forest camps.

CONCLUSIONS

The Aka evidence provides only mixed support for evolutionary and developmental theories on aggression. Although preadolescent and adolescent boys were more physically aggressive than girls, as predicted, men were not more physically aggressive than women, contrary to predictions. Controlling for anger, adult women did gossip more than men, as predicted, but contrary to predictions teenage girls did not gossip more than teenage boys. It may be that the models are underspecified and certain cultural variables, such as camp size, are masking the expected sex-biases in some age groups. High levels of relatedness among group members, which could conceivably reduce aggression, may be another complication. Additionally, there are few studies which quantify aggression within hunter-gatherer cultures, and due to time constraints, no comparative sample of the Ngandu villagers was made. As a result, it is unclear where the Aka fit on aggression measures in small-scale societies. Greater understanding of the origins and developmental trends in aggression necessitate additional research among these populations. Studies that quantify aggressive behaviors will allow clarification of the effects of biology, environment, and culture in the development of aggression and perhaps reveal current biases derived from the emphasis on Western populations.

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