Informational Warfare:

Coalitional Gossiping as a Strategy for Within-Group Aggression

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Abstract

Evolutionary scholars often emphasize the strategic benefits of coalitions in male aggression and warfare. Evolutionary theories of human female coalitions, however, have not recognized any competitive function for coalitional behavior, and instead emphasize mutual nurturing and help with childcare. This focus is despite the fact that a significant body of research has shown that coalitions in nonhuman female primates do serve competitive functions. I argue that coalitional relationships among human females—like those among human males and like those among female nonhuman primates—serve aggressive functions in reputational competition. I further argue that, for either sex, competition via gossip and coalitional gossip is usually a better strategy than physical aggression when it comes to within-group competition. Finally, I argue that, because human females might face more within-group competition than human males, women and girls might engage in more gossip than men and boys.

Keywords: informational warfare, gossip, coalition, indirect aggression, reputation, friendship, sex-differences, cooperation

Resource competition and the evolution of coalitions

Evolutionary accounts of coalitional relationships among human males emphasize the role of physical aggression in obtaining valued, limited resources (Chagnon,1988; Kurzban, 2001; Tiger, 1969; Tooby & Cosmides 1988; Wrangham & Peterson 1996). When physical force determines access to important resources like food, territory, and mates, alliances and coalitions provide a distinct advantage to their members because larger groups will almost always outcompete smaller groups or individuals for the valued resource.

Most evolutionary theories of coalitional aggression ignore, or even deny, that women's relationships are used in female-female aggression. For example, the influential 'tend and befriend' account of women's relationships proposed by Taylor and colleagues (2000) emphasizes the evolutionary benefits of women's mutual nurturing, caregiving, and emotional support under stressful conditions. Whether or not this account is correct (see Hess, 2006a, pp. 134-142 for a detailed critique), it misleadingly suggests that women's friendships play little role in competition with other women. Another account of coalitional aggression among women suggests that women form coalitions to protect themselves from physical aggression by men (Smuts, 1992, 1993). Smuts points out that, whereas in patrilocal societies women typically live with the husband's female relatives who share *his* interests in asserting control over his wife, in matrilocal societies, the wife's female relatives are nearby and can intervene to protect her from spousal abuse (Smuts 1992, p. 13-14 and Smuts & Smuts 1993, especially p. 34-35). These evolutionary theories leave the impression that women's coalitions serve benign or defensive functions but not competitive, offensive functions. Here I develop a theory of coalitional aggression

in which groups collect, analyze and disseminate information to harm the reputations of competitors. I term this form of coalitional aggression *informational warfare*, and argue that human females are more inclined to compete with informational warfare, whereas males compete using either physical warfare or informational warfare.

The socioecological model

The view that the coalitional tactics of human females are intrinsically benevolent is inconsistent with well-established findings that female nonhuman primates often form alliances and coalitions to better physically compete with other females for limited resources. Female primates fight against other females, often in coalitions, and whether and how they do so varies across and within species.

Primate sociality probably evolved as a defense against predators (van Schaik, 1983) and/or to enhance abilities in competition with conspecifics over resources (Wrangham, 1980). Not all primates live in groups, but studies of primates that are social have revealed substantial variation in the patterns of relationships that form among group members. In primates, and many other taxa, female fitness is primarily constrained by access to resources, and male fitness is primarily constrained by access to females (Trivers, 1972; Wrangham, 1980; Lindenfors, Froeberg, & Nunn, 2004). Under the *socioecological model*, ecological conditions predict the degree to which females directly compete for resources which, in turn, predicts the nature of female relationships (e.g., van Schaik, 1989; Sterck, Watts, & van Schaik, 1997; Silk, 2002a, b; Isbell &Young, 2002, c.f. Wrangham, 1980).

With regard to within-group competition only, resources that are valuable, clumped, and easily monopolized by one or more group members lead to strong within-group contest competition, involving intimidation and physical displacement of competitors. The overt, within-group agonistic interactions inherent to contest competition drive selection for alliances and coalitions to enhance physical competitiveness, as well as the dominance hierarchies that decrease the costs of fighting for all (Schjelderup-Ebbe, 1922). Frugivorous primates, whose food resources are high-value, clumped, and therefore monopolizable, tend to display these social patterns.

In contrast, ecological conditions in which resources are low-value, dispersed, and abundant—and that therefore need not or cannot be monopolized—select for within-group scramble competition. Displacement efforts and aggression rates are low (because one animal's access to food is not limited by the efforts of another), as are the benefits of alliances/coalitions and dominance hierarchies. Folivores, for example, tend toward scramble competition rather than contest competition because leaves are usually abundant and nonmonopolizable. Data from several primate taxa generally support these and other predictions about female within-group competition derived from the socioecological model, as well as many other predictions about relationships between ecological and social variables, such as between-group competition, predator avoidance, sex, and infanticide (e.g., Barrett &Henzi, 2002; Boinski, Sughrue, Selvaggi, Quatrone, Henry, & Cropp 2002; Isbell & Young 2002; Kappeler & van Schaik 2002; Koenig 2002; Silk 2002a; Sterck, Watts, & van Schaik 1997; but see Janson, 2000).

Tufted capuchin monkeys (genus *Sapajus*) nicely illustrate the socioecological model. The bearded capuchin monkey (*S. libidinosus*) and the black-horned capuchin monkey (*S.*

nigritus) are closely related Brazilian species that resemble each other in many respects: group sizes are similar, sex ratios are similar, and both have the same polygynous mating system. The environments of each species differ substantially, however. *S. libidinosus* lives in a seasonally dry open woodland with high availability of fruit, whereas *S. nigritus* lives in an area covered by dense evergreen trees with no dry season, and lower availability of fruit but abundant access to leaves. As predicted by the socioecological model, within-group food competition is higher in *S. libidinosus* and lower in *S. nigritus.* Accordingly*, S. libidinosus* females stay in their natal groups and form linear dominance hierarchies and coalitionary grooming relationships. *S. nigritus* females*,* on the other hand, tend to transfer between groups, and form egalitarian relationships with no hierarchies or coalitionary relationships (Izar, et al., 2011).

The socioecological model is meant to explain the evolution of relationships among female nonhuman primates, but applied to humans, it may be useful in understanding coalitional relationships in both sexes. Chapais (1996, pp. 19-20) makes the point that because "competing through cooperation" (i.e., via alliances and coalitions) is so widespread in primates, it was probably present in an early primate ancestor. Humans might therefore have inherited the basic psychological architecture for seeking allies and forming coalitions to increase success in contests over resources and dominance. Humans, however, have unique cognitive abilities such as language, and are highly prosocial compared to most primates, widely sharing food and other valuable resources. For instance, food sharing is ubiquitous among contemporary human hunter-gatherers (Kaplan & Gurven, 2005). Consequently, Chapais argues, humans appear to have extended their primate legacy well beyond simply pooling physical power to also pool,

e.g., services, goods, and information in order to better compete with other groups. The key, distilled insight of the model that I argue is particularly relevant to the human case is that alliances and coalitions are useful in contest competition. Under the socioecological model, a human ecology that involved valuable, monopolizable resources should have selected for psychological adaptations to form coalitions and alliances because these would have dramatically enhanced competitive formidability.

How monopolizable were food and other valuable resources in human groups over evolutionary time? Although evidence for central place foraging (repeatedly bringing food to the same location) by early Pleistocene Homo is controversial (O'Connell, et al., 2002), there is clear archaeological evidence from the late middle Pleistocene and later that Homo hunted big game, returning large packages of meat to caves and other central sites where it was processed and consumed by multiple individuals (Stiner, 2002). Most theorists of food sharing agree that, although contemporary foragers share meat widely, meat distribution is usually controlled by the hunter or other individuals, and can be directed to, for example, offspring and other kin, spouses, sex partners, or reciprocal partners (for review, see Kaplan & Gurven, 2005; the tolerated theft model is an exception; see Blurton Jones, 1984, 1987).

In addition to meat, contemporary small-scale societies, including foragers, rely heavily other kinds of resources that are valuable, limited, and monopolizable. Examples of such resources include scarce nutrients like salt (personal observation), artifacts like weapons and tools (Kelly, 1995), drug plants (Roulette, Hagen, & Hewlett, in press), or territories (Dyson-Hudson & Smith, 1978). Social partners, such as mates and friends, are also monopolizable (e.g., Noë & Hammerstein, 1994; Barclay & Willer 2007; Buss

1988a, b). With regard to mating partners, men can benefit by competing for fertile and sometimes multiple mates, and, because human fathers (unlike most mammalian fathers) often invest significant material and social resources in offspring (e.g., Hewlett, 1992), women can benefit by competing for monopolizable mates that are able to provide many resources (e.g., Buss, 1988a, b; Campbell, 1995). Like meat, most of these valuable, limited, monopolizable resources are obtained by cooperating with other members of one's society.

Hunter-gatherer societies have a hierarchical structure, and material, social, informational, and genetic resources are exchanged among all levels. In one scheme, individuals are nested within nuclear families, which are nested within dispersed mobile residential groups, which are nested within annually aggregated residential groups, which are nested within larger socio-economic groups that aggregate every few years, which are nested within a regional ethnic group (Binford, 2001; Hamilton, et al. 2007). For the purposes of this chapter, 'group' refers to the local residence group.

Humans engage in contest competition for limited material and social resources with other humans both within and between groups (e.g., Hawley, 1999; Hawley, et al., 2008). It follows from the socioecological model that both sexes should exhibit the aggression, alliances, coalitions, and dominance hierarchies that are associated with contest competition (in primatology, alliances are long-lasting relationships; coalitions are the temporally delimited groups of two or more allies that form to attack one or more individuals; Pandit & van Schaik, 2003). At the between-group level, human males commonly aggress in coalitions, often kin, for the kinds of limited resources described

above—in other words, men engage in warfare and raiding (e.g., Chagnon, 1988; Tooby & Cosmides, 1988; Wrangham & Peterson, 1996).

Human males physically contest over social and material resources within groups as well (Barker, Barclay, & Reeve, 2012), often forming within-group coalitions and dominance hierarchies, where age, kinship, and descent play large roles (e.g., Hawley 1999). Among !Kung hunter-gatherers of Southern Africa, between 1920 and 1955, for instance, poisoned arrow fights occurred on average once every two years, typically over a woman (Lee, 1984). Lee recounts an incident in which a young woman was promised to one man, but another man wanted to take her as a second wife. The second man attacked the first, whose father came to his aid; other men supported the second man, and more relatives were drawn in on both sides. None of the four wounded in the ensuing melee were principals in the original argument over the woman. Chagnon (1968) relates a similar incident among the Yanomamö, hunter-horticulturalists from South America, in which a young woman was promised to her older sister's husband, but instead started an affair with another young man. The husband challenged the young man and his father to a club fight, and the latter two backed down.

Among women, there appears to be little, if any, evidence for physical coalitional aggression, either between or within groups. That is, women do not form groups to physically attack other women. As Rodseth, et al. (1991) pointed out, unlike female bonds in other primates, the close, affiliative bonds women form with other women are not used aggressively in physical competition. Indeed, though some evidence indicates individual women do occasionally aggress physically against each other (Burbank, 1994), there is no evidence that women regularly form alliances or coalitions to physically

compete for contestable resources. Rodseth et al. 1991 concluded that relationships among women:

> seem to be characterized by high degrees of noninterference mutualism, i.e., cooperation that does not impose a cost on any 'third party.' This varies little with residence pattern, so that even unrelated women in the most extreme patriarchal societies…regularly engage in peaceful cooperation toward common goals with close and enduring friendships (e.g., Abu-Lughod 1986). Such an observation would seem mundane if it were not for the striking contrast with dispersing females in other primates. (p. 232).

We are thus left with an apparent contradiction. When resources are clumped and monopolizable, females in non-human primates form coalitions and alliances to better compete for, and defend, these resources. Ancestral human groups were characterized by clumped, monopolizable resources. Yet, although men form coalitions and alliances to physically compete for these resources, consistent with patterns seen in non-human primates, women do not. Either the assumption about ancestral human groups is incorrect, or the socioecological model is incomplete or incorrect.

Despite the apparent lack of coalitional aggression in human females, I will now argue that, just like females in other primates, coalitional relationships among women and girls do function to facilitate aggressive within-group competition for valuable, monopolizable resources. I will argue, however, that this aggression relies not on physical but informational capabilities, and that it can be used strategically by either

males or females. This perspective will also explain why women tend to avoid physical aggression.

Evolutionary models of cooperation emphasize reputation

Unlike in most non-human primate societies, many of the valuable and monopolizable social and material resources that are important to human fitness, such as food, mates, protection, and care, must be obtained from others. Empirical studies in small, kin-based societies indicate that reputation is an important mediator of access to the social and material resources that are provided by others. Among the Yanomamö, for instance, a reputation for fierceness appears to increase access to wives (Chagnon, 1988). Among the Ache of Paraguay, a reputation for generosity increases donations of food when one is sick (Gurven, et al., 2000; see also Sugiyama & Chacon, 2000). Sugiyama and Scalise Sugiyama (2003) similarly find, across a broad range of societies, that individuals cultivate reputations as providers of difficult-to-replace benefits, which motivate others to help them should they become injured or sick. Among the Hadza, hunter-gatherers in Tanzania, men with better reputations as hunters have harder-working wives and more children (Hawkes, O'Connell, & Blurton Jones, 2001; Marlowe, 1999). Among the Meriam, indigenous foragers in Australia, men with reputations as successful hunters had an earlier onset of reproduction, higher age-specific reproductive success, and more and higher-quality mates. Women with better reputations as hard workers, in turn, were preferentially chosen by the best hunters (Smith & Bliege Bird, 2000; Smith, Bliege Bird, & Bird, 2003).

In experimental economics experiments, in which typically anonymous subjects have the option of sharing real money with other subjects or keeping it for themselves, sharing

can be sustained if players are allowed to develop reputations as donors; otherwise it collapses (e.g., Milinski, Semmann, Bakker, & Krambeck, 2001; Milinski, Semmann, & Krambeck, 2002; Wedekind & Milinski, 2000).

Reputation also plays a central role in recent evolutionary models of human cooperation. In the indirect reciprocity theories (Alexander, 1987; Leimar & Hammerstein, 2001; Mohtashemi & Mui, 2003; Nowak & Sigmund, 1998; Panchanathan & Boyd, 2003), benefits are provided to an individual based on information about his or her past contributions to others in the group—generous individuals are rewarded by receiving benefits from group members. In the 'health-insurance' theories (Gurven, et al., 2000; Sugiyama & Chacon, 2000), individuals increase the likelihood that they will be taken care of when ill or injured by generously providing benefits to group members when they are well. In the 'show-off' or 'costly-signaling' theories (Gintis, et al., 2001; Hawkes, 1991; Smith & Bliege Bird, 2000), individuals engage in behavior, such as big-game hunting, that signals their quality as mates or social partners, and consequently reap valuable mating or social benefits (wee Smith & Bleige Bird, 2000 for a discussion of the similarities and differences between their 'costly signaling' model and Hawkes' 'show-off' model).

Reputation can also play an important role in reciprocal altruism models (e.g., Cox, Sluckin, & Steele, 1999; Enquist & Leimar, 1993; Pollock & Dugatkin, 1992). In these models, individuals benefit from learning whether future social partners previously defected or cooperated with other social partners. In more sophisticated versions of these reciprocal altruism models, if the values of benefits that individuals provide vary, then individuals should attempt to cooperate with those who can provide the greatest benefits

at the lowest cost. Due to the fact that cooperation with one individual may necessarily preclude cooperation with another, individuals may have to compete for cooperative partners, resulting in a market for cooperators (Bull & Rice, 1991; Nöe, 1992; Nöe & Hammerstein, 1994; Nöe, Van Schaik, & Van Hoof, 1991); these markets have been argued to be particularly important in humans (e.g., Dugatkin, 1995; Gilbert, 1997; Hagen, 1995; Henrich & Gil-White, 2001; Tooby & Cosmides, 1996). Thus, providers of valuable benefits can themselves be commodities over which individuals compete. Note that individuals may have different reputations in different markets. For example, a woman may be avoided as a foraging partner, but sought after as a political partner, which indicates that reputation is multidimensional.

In each of these models, as several authors have noted (e.g., Enquist & Leimar, 1993; Leimar & Hammerstein, 2001), *information* about key behaviors (such as generosity to others or a successful hunting expedition) must be reliably transmitted to group members. Although direct observations are obviously informative in the indirect reciprocity models, key behaviors may also be communicated to other group members by the few observers of individual acts of generosity. The show-off/costly signaling and health insurance models assume that the key behaviors will be directly observed by those who ultimately provide benefits. However, with these models too, most group members will not directly observe who killed the elephant, but will have to rely on reports (as well as seeing the dead elephant) to properly assign credit to the successful hunter or hunters. Further, although the health insurance models posit that beneficiaries of past generosity will have a fitness interest in caring for providers when they are injured, it would be reasonable to extend this model. For example, it would be in the fitness interests of all *potential*

beneficiaries to care for an injured provider (even if some had not been personal beneficiaries in the past), because they could benefit from the future generosity of the provider when she is well. In this extended version, information about individual acts of generosity must be transmitted to other group members by observers of these acts.

These empirical and theoretical results suggest that in order to maximize the benefits one acquires from others, one must achieve and maintain a reputation for being able to provide valuable benefits to others. One's reputation is based on information about one's traits, behaviors, intentions, abilities, and culturally-specific competencies. Direct observations of key characteristics and actions are informative, but because it is impossible to observe everyone all of the time, information relevant to an individual's reputation is often obtained via reports from others rather than eyewitness accounts.

Gossip as the manipulation of reputational information

If reputation did regularly mediate access to contested social partners and the resources they provided in ancestral environments, there would have been a selection pressure for adaptations to manipulate reputations to one's own benefit—to attack and defend reputations with information. This would involve providing information to resource providers that impugned the reputations of competitors or enhanced one's own reputation (or the reputations of one's kin and allies), and withholding information that enhanced the reputation of competitors or damaged one's own.

'Gossip' is a construct that captures the notion of information exchange about the doings of others. One definition of gossip states:

> Gossip is informal, private communication between an individual and a small, selected audience concerning the conduct of absent persons or events. Gossip thrives when the facts are uncertain, neither publicly known nor easily discovered. Gossip generally contains some element of evaluation or interpretation of the event or person, but it may be implicit or unstated. (Merry, 1984, p. 275)

Several evolutionary psychologists (Barkow, 1992; Buss & Dedden, 1990; DeBacker, 2005; Hess & Hagen, 2006a; McAndrew & Milenkovic, 2002) and non-evolutionary social scientists (e.g., Emler, 1990, Paine, 1967; Radin 1927) have offered reasons for why people gossip. Some researchers have taken an individual-centered approach, arguing that individuals compete for scarce resources by using information to damage their opponents' reputations and improve their own (Barkow, 1989, 1992; Buss & Dedden, 1990; Emler, 1990; Leimar & Hammerstein, 2001; McAndrew & Milenkovic, 2002; Paine,1967; Radin, 1927). The empirical evidence that gossip is self-serving and competitive includes the wide body of research on nonphysical aggression, variously termed relational-, social- or indirect- aggression (e.g., Grotpeter & Crick, 1996; Galen & Underwood, 1997; Bjorkqvist, Oserman, & Kaukianian, 1992; Owens, et al. 2000a, 2000b; Underwood, Galen, & Paquette, 2001). In each of these forms of aggression, individuals aggress against others using gossip and other nonphysical tactics. These forms of aggression have been documented in over 60 studies on four continents (see Archer, 2004, and Archer & Coyne, 2005 for reviews; see Goodwin, 1990a, b for a detailed ethnographic account of gossip in conflicts

among children). In a study of college women, for example, Holland and Eisenhart (1990, p. 114) present "Rosalind's" account of what one woman did in order to attract Rosalind's boyfriend. This account clearly illustrates the use of apparently false gossip to attack a competitor's reputation in order to obtain a valued resource—a mate:

> That girl would do anything in her power to spite me...She's always trying to get something against me...[the authors ask what the woman would do] Well, to start off she likes [my boyfriend]. And she'll tell him things [lies] about me.…And she'll come over to [my neighbor's] room. You can hear right through the walls. She'll even open the door...and she'll strike up a conversation about me. She calls me every name in the book...trying to provoke me into fighting her...and trying to make [my boyfriend] think that I'm lying to him...[She'll be] telling him that some [other] man paged me...or came and picked me up...[when] no guy called me that morning...or picked me up. (brackets and omissions in the original)

Similarly, McAndrew and Milenkovic (2002) found that participants were more likely to pass on negative information than positive information about potential adversaries, and that subjects were quite likely to share positive information about friends and relatives, but not negative information.

Gossip, broadly construed, probably has many other functions, some of which have been explained using evolutionary principles. Barkow (1992) views gossip as information

that had important implications for individuals' fitness-relevant social strategies in the ancestral environment (also known as the Environment of Evolutionary Adaptedness, or EEA). Gossip has been argued to be: 'cultural learning' (e.g., Baumeister, Vohs, & Zhang, 2004); 'social learning,' such as learning norms or one's place in a group (e.g., Eckert, 1990; Fine, 1977; Fine & Rosnow, 1978; Gottman & Mettetal, 1986; Suls, 1977) or acquiring new and important knowledge (e.g., Watkins & Danzi, 1995); strategy learning (DeBacker, 2005); social 'bonding' (e.g., Dunbar, 1996, 2004); social comparison (e.g., Wert & Salovey, 2004); a mechanism for showing off one's social skill and connections, and therefore one's mate value (Miller, 2000); norm learning and enforcement or 'policing' (e.g., Wilson, Wilczynski, Wells, & Weisner, 2000); a means to maintain the good reputations of allies (e.g., Brenneis, 1984); and a means to maintain the unity, morals, and values of social groups (e.g., Gluckman, 1963).

Language can be used to communicate on a variety of topics, so it is not surprising that there are a number of theories for the function of 'gossip.' What is surprising is the degree to which different definitions and theories of gossip overlap with one another — even those developed from the study of a range of diverse cultures, such as the Native American Makah and Hopi (Colson, 1953; Cox, 1970), rural Spanish (Gilmore, 1978), urban African Americans (Goodwin ,1990a, b), Caribbean peasants (Abrahams, 1970), Polynesian Nukulaeae (Besnier, 1989), Fijians and the Caribbeans (Brenneis 1984, 1987), and the Zinacantan of Chiapas, Mexico (Haviland, 1977). Most researchers agree that gossip is intimately related to reputation and the doings of others, and plays a central role in community dynamics.

One major disagreement, vetted in a brief flurry of articles in the late 1960s, was whether gossip functions primarily at the group level (e.g., Gluckman, 1963, 1968) or individual level (e.g., Cox, 1970; Haviland, 1977; Paine, 1967; Szwed, 1966). The debate "came to an abrupt halt as it appeared obvious that we were riding the old warhorses–psychology or sociology: the individual or the group" (Wilson 1974, p. 93). To briefly recap, Gluckman (1963, 1968) typified those who viewed gossip functioning primarily at the group level. Though recognizing a within-group competitive aspect to gossip, he argued that gossip functions primarily to "maintain the unity, morals, and values of social groups," and to promote within-group solidarity and between-group separation (Gluckman, 1963, p. 308; Colson, 1953). This idea has recently been promoted by evolutionary scholars who favor various forms of group selection (e.g., Wilson, et al., 2000).

Paine (1967) conceived of gossip as strategic "information-management," and typified those who viewed gossip as functioning primarily at the individual level. Paine responded to Gluckman by offering an analysis of gossip as competition-oriented "information-management," arguing that "...discussion of the values of gossipers is best related to what we can find out about their self-interests; I would hypothesize that gossipers also have rival interests; that they gossip, and also regulate their gossip, to forward and protect their own interests" (p. 280). Similarly, Brenneis, a linguistic anthropologist, discusses reputation manipulation in conflicts via gossip among the Hindi-speaking Fijian Indians in the rural village of Bhatgaon (1984, p. 489):

> [I]ndividual reputation is central to one's actual social position. A man's reputation is subject to constant renegotiation through his own words and deeds and through those of others. Villagers are quite sensitive to perceived attempts by others to lower their reputations; the fear of reprisal by the subject of a gossip session has an important constraining effect upon the form of those sessions. Reputation management is a constant concern in disputes, for conflict often arises from apparent insult, and the remedy lies in the public rebalancing of one's reputation with that of one's opponent.

Bloom (2004) suggests that gossip is probably not a natural kind; e.g., there is no neurophysiologically or psychologically distinct mechanism that produces only gossip statements, nor are there any linguistic features that uniquely characterize all gossip statements. Therefore it has no single function, and thus, both camps could be correct. Gossip as strategic reputation management is consistent with evolutionary arguments for methodological individualism – that social facts can be explained by reference to individual actions and motivations (e.g., Smith & Winterhalder, 1992). As such, the view of gossip as self-serving reputation management aligns more closely with Paine's view than with Gluckman's. The Paine-Gluckman debate was really a debate about whether (group-level) functionalism is correct; that is, are there institutions that serve some function for the group that is independent of individual motivation? If functionalism is correct (e.g., Richerson & Boyd, 1998; Richerson & Boyd, 1999), some form of socially sanctioned negative 'gossip' should play an important role (Wilson, et al., 2000). Whether or not it is correct, it is clear that gossip is used competitively between individuals and factions within groups.

One category of hypothesis garnering increasing attention attempts to link gossip to the evolution of human cooperation (see Dunbar, 2004). Humans have language, and humans cooperate extensively with non-kin, so it is hypothesized that there is a causal relationship between these phenomena. Dunbar (1993, 1996, 2004) advocates a theory of gossip that occupies a middle ground between the individual competition view and the group functional view. Dunbar proposed that language and gossiping evolved to replace grooming as a facilitator of social bonding among primates. If our ancestors, whose group size Dunbar estimates at 150 individuals, followed nonhuman primate patterns, they would have spent an inordinate 40% of their time grooming one another to maintain cohesion in such large groups. According to Dunbar, an alternative mechanism to grooming had to evolve to allow people to maintain the bonds among individuals necessary to live in large groups; Dunbar suggests that this alternative might have been language. Language can be used to address multiple individuals, reducing effort, and it allows people to communicate information about their own and others' behaviors and mental states (i.e., to gossip). Given socially relevant topics are important to social bonding, language may have evolved to allow social bonding in larger group sizes.

More recent versions of the idea that gossip allowed for the evolution of cooperation in humans explore gossip as a mechanism for indirect reciprocity. Gossip, defined as information obtained via communication rather than direct observation, has been demonstrated to influence cooperation in various experimental economic games (e.g., Beersma & van Kleef, 2011; Mollerman, van den Broek, & Egas, 2013; Sommerfeld, Krambeck, & Milinski, 2008, & Sommerfeld, et al., 2007.) Sommerfeld, et al. (2007,) for example, found that gossip about cooperative individuals was more positive than gossip

about uncooperative individuals, and cooperation levels were higher when people encountered positive gossip compared with negative gossip.

Gossip clearly serves multiple functions. As we have seen, however, the evidence strongly suggests that gossip is, at least in part, an aggressive, exclusionary, and competitive strategy that serves the needs of individuals of both sexes who may or may not be cooperating in small groups. Gossip researchers have yet to design studies that explicitly test any one of these theories pitted against any another.

Informational warfare: The coalitional manipulation of reputations

I propose that alliances and coalitions are valuable in contests over monopolizable resources where the 'weapon' is not just physical aggression, but reputational manipulation, via gossip. Just as cooperating men are more powerful than individuals in using combat and intimidation in physical warfare, cooperating individuals of either sex are more powerful than individuals in using information to attack, and threatening to attack, the reputations of their competitor(s) in informational warfare. An important implication is that, whereas most other theories of coalitional aggression explicitly deny that women aggress in coalitions, this perspective holds that women aggress in coalitions at least as frequently as men.

There are several reasons why coalitional relationships can be beneficial in reputational contests. Two analogies are helpful. Coalitions that engage in reputational contests function somewhat like a team of detectives trying to piece together the doings of others. They also function somewhat like a supercomputer cluster that can solve more complex problems than can a single computer.

1. Improved information collection

Coalitions provide more eyes and ears through which to collect accurate information about competitors. Information can be difficult to obtain because people try to actively conceal certain behaviors (e.g., extramarital affairs), because key behaviors or demonstrations of abilities occur infrequently (e.g., reaction to enemy attack), or because cues to the occurrence of key behaviors or traits are too subtle to notice without careful attention (e.g., disease resistance). The more individuals there are who are trying to collect information that is rare and difficult to obtain, the more likely that information is to be found.

2. Improved information analysis

Coalitions can more thoroughly analyze information than individuals working alone. Multiple members can provide additional, relevant information, offer different perspectives on the same piece of information, and bring a more diverse array of past experiences to bear on the interpretation of the available evidence. Together, these would substantially enhance the analysis of new gossip.

3. Improved information dissemination

Coalitions can provide more vectors (mouths) through which to strategically disseminate information. Further, some coalition members may have network ties to target recipients of certain information. Some members would also be able to identify costs and/or benefits of disseminating particular details, or could offer especially effective interpretations of these details, and thus, together, could craft a version of the gossip that would have the maximum influence.

4. Greater believability for information recipients

Information reported by coalitions may be more believable than that reported by an individual. Random error (noise) can degrade information as it is communicated among different parties, but the probability that multiple accounts contain the same random error decreases rapidly as the number of parties transmitting the information increases. Information reported by multiple parties is also more believable, as lying entails different costs and benefits for different people. That is, the benefits of lying might outweigh the costs of lying for one party, but the benefits of lying are less likely to outweigh the costs of lying for additional parties. Thus, information reliability increases when multiple, independent sources attest to the same story. Hess and Hagen (2006a) showed that gossip believability decreased with the addition of noise and information that gossipers may have ulterior motives. Gossip believability also increased with reiteration of the gossip, and with source multiplicity (i.e., gossip being reiterated by the same source or by a different source or sources). Gossip believability also increased with source independence in that gossip relayed by multiple sources who had independently seen and reported the event was more believed than gossip from multiple sources where one source had heard of the event from the other source.

5. Improved defense against attacks

Defensive manipulation of the reputations of oneself, one's kin, and one's allies can be just as important as offensive manipulation of the reputations of one's competitors. For the reasons outlined above, coalitions may protect members' reputations by providing alibis and evidence against harmful accusations.

The distinction between collecting and analyzing information on the one hand, and disseminating information on the other, is important, and can be illustrated by again drawing on the physical warfare analogy. In physical warfare, group violence can be extremely costly to both sides. A well-prepared group can effectively deter attacks, however, thereby avoiding the costs of fighting. Groups spend considerable time preparing for physical warfare by building weapons, patrolling boundaries, solidifying coalitional ties, sharing information about enemies, and reviewing past battles. In informational warfare, a coalition that invests effort in collecting and analyzing information is more likely to damage the reputations of competitors, and is better able to defend the reputations of its members by providing effective alibis and evidence against accusations. Trading reputational attacks can be so costly to all competing factions, so coalition members should not engage in unrestrained dissemination of harmful information about competitors. Rather, coalitions should spend considerable time readying themselves for informational warfare by collecting and analyzing relevant information. As with physical warfare, effective threats and deterrence of attacks are a major goal of a coalition's activity.

The costs of collecting and analyzing information, like the costs of preparing for war, are not trivial. Information that occurs infrequently or that is concealed or subtle can take a significant amount time to acquire, as can learning background information that is relevant to its processing. Sorting through and synthesizing combinations of fragmentary information into a complete account that might matter to current or future reputational contests of oneself or one's allies, and then deciding what to do with that information based on the current competitive climate, is also time consuming. The effort and

concentration devoted to the collective analysis of reputational information could be spent on alternative tasks, such as processing fitness-relevant information that is not of a social nature.

There is an interesting sex difference that might be related to potential differences in informational vs. physical warfare. Researchers have found that girl's play groups are smaller than boy's play groups (Laosa & Brophy, 1972; Omark & Edelman, 1973; Lever 1974; cited in Eder & Hallinan, 1978; Goodwin, 1990b, pp. 38-39; Waldrop & Halverson, 1975). Girls also more often view outsiders as threats to existing close friendships rather than as contributors to a larger coalition. In a study of children, Eder and Hallihan (1978) found that, because of the exclusivity of dyadic female friendships, newcomers had a hard time making friends. Eder and Hallihan also report that girls' triadic friendships were more exclusive than boys' triadic friendships, and that girls had more exclusive triadic friendships than they did nonexclusive triadic friendships. Benenson et al. (2008) report that 10-year-old girls were more likely than boys to ostracize a same-sexed peer. Similarly, Feshbach and Sones (1971) reported that adolescent girls made less favorable judgments of newcomers than did adolescent boys. Owens et al. (2000b) reported that jealousy over female friends was particularly intense, and described the phenomenon of "a girl 'poaching' [stealing] another's best friend," sometimes using negative gossip, as was suspected by one informant in their study: "I reckon that Brooke and her were good friends and very close and probably somebody, another girl in the group, wants to be very close to Brooke and she goes and spreads something about Jo."

When it comes to conflicts specifically, Xie, Cairns, and Cairns (2002) found that in a

US school population, whereas 97% of physically aggressive conflicts (characteristic of boys) involved dyads, 70% of socially aggressive conflicts (characteristic of girls) involved at least triads.

To the extent that girls tend to play at informational warfare, whereas boys tend to play at physical warfare, these differences in girls' vs. boys' coalitions might reflect some important differences in informational vs. physical warfare. If informational warfare occurs primarily within groups, then the sizes of competing cliques within groups would obviously be smaller than the size of the group as a whole.

The informational warfare model also resembles modern-day computer clusters that can solve more complex problems than single computers. To do so, computers must be connected via high-speed communication channels. A "cluster" of human brains, however, is "connected" by a relatively slow communication channel, language, and typically only one person can talk at a time. Thus, cliques would increase efficiency by allowing one person to inform several other people by telling the story once. However, if, as seems likely, information processing were enhanced by *conversation,* and not simply story-telling by one person, then the potential complexity of the conversation could increase rapidly with group size, as each person might need to respond to *every other person*; thus, the potential complexity grows as n(n-1)/2, or quadradically with group size. This might serve to limit the number of participants in groups engaging in informational warfare, much as it does the number of central processing units (CPUs) in computing clusters that tackle non-parallelizable problems (Martin, et al., 1997.)

In informational warfare, in order for every member to contribute to, and benefit from, membership in the coalition, each member must process collected information and

recent events with respect to the life circumstances of every other coalition member. This information-processing load cannot easily be divided among coalition members—everyone has to have the full story in order to make a worthwhile contribution. Despite the improved ability of larger coalitions to collect and disseminate information, the substantial amount of time it takes to process new information from, and about, each coalition member places a severe constraint on coalition size. This constraint would be relaxed if cooperation were not based on reciprocity but instead on, for instance, a single mutual threat. For example, modern political campaigns employ large teams to dig up dirt on a small number of opponents.

In contrast, in physical warfare against a common enemy, there is no fixed resource like time that must be divided among each and every coalition member. If the potential benefits of warfare and the local resource base are large enough, the advantages of large coalitions will outweigh the disadvantages. Coalitions taking part in informational warfare should be considerably smaller than those used in physical warfare, and are perhaps better referred to as cliques.

Empirical support for informational warfare

Although informational warfare theory as outlined here has not yet been tested explicitly in published research, some examples from the literature provide partial, indirect support. Ethnographic and psychological studies of gossip and conflict show that people gossip in groups, and that a primary objective of such gossiping is to diminish others' reputations. Goodwin (1980, 1982, 1988, 1990a, 1990b) studied the phenomenon of the 'he-said-she-said' gossip dispute. In ethnographic studies of play, communication, and group formation in inner-city children, Goodwin (1980) found that the conflicts of

female neighborhood playgroups took the form of coalitional, verbal confrontations, often in the form of small groups against individuals. Girls presented their stories such that hearers became aligned with speakers, then formed consensus against absent parties (Goodwin 1990a). Goodwin described how girls strategically distributed gossip and recruited allies against a third party:

> [The] storyteller skillfully works to align hearer with teller against an absent third party. A coalition of what the girls call "two against one" (storyteller and hearer against absent third party) is established in the immediate interaction. From the teller's perspective, the offended party's alignment is important for bringing forth a future confrontation. From the recipient's perspective the fact that at least two parties agree on a particular version of an event provides a warrant for bringing action against a third party. (Goodwin 1990a, p. 128)

Goodwin (1982) also suggests that when verbal confrontations among girls occur, the accuser usually wins, due, in part, to the accuser's alliances. In contrast to the general assumption that girls tend to avoid conflict, Goodwin (1990a) suggested that they in fact compete fiercely with other girls, and that the competition reveals a coalition structure among girls:

> Girls affirm the organization of their social group through assessing the behavior of absent parties. The alliances formed in the process of discussing others mark who is included and excluded from the social group of the

> moment, rather than relative rank.
>
> …
>
> As the data presented here vividly show, within the he-said-she-said storytelling event, girls react with righteous indignation when they find that their character has been maligned. They display an intense interest in initiating and elaborating disputes about their rights (not to be talked about behind their backs) that differentiate offending and offended parties. *Alignments* taken up during such disputes clearly demarcate who stands within the bounds of an inner circle of friends, as well as who is regulated to that circle's periphery. (Goodwin 1990a, p. 129; emphasis added)

Leaper and Holliday (1995) similarly showed that adult females use gossip to promote solidarity in an "us vs. them" manner. Proveda (1975, p. 133) suggested that gossip is the weapon by which girls manipulate information, and that this manipulation of social information appears to explain how girls' coalitions differ from boys' coalitions:

> Gossip, of course, is the major weapon which girls use to regulate information about each other. This method of informal social control accounts for the tighter clique structure among girls than boys, as well as the nature of peer group solidarity among girls. Girls frequently describe other girls as friendly and well-liked within their own group, but unfriendly to outsiders. It is apparent that the clique is crucial in the regulation of information about peers. What is known to one member of a clique is known to all; therefore, it is

> important to control and limit the association patterns of the clique. The vulnerability of girls to revealing or not revealing information about the self makes girls much more sensitive to social criticism than boys. In this sense, the girl's fate rests with the fate of the clique….

Work by Owens, et al. (2000a, 2000b) on indirect aggression showed that "intimacy" was achieved within groups of female friends when non-members were derogated, and that derogating others was often needed to gain acceptance into (or maintain a position in) a particular group, suggesting the group nature of female competition. Other aggressive tactics identified by Owens, et al., such as ostracism, breaking confidences, and discussing victims, are all inherently cooperative forms of competition (i.e., at least two aggressors are required). Supporting the idea that coalitions facilitate the dissemination of information, Owens, et al. (2000b) found that "the girls in the present study revealed that the act of revenge often involves utilizing other members of the group through the spreading of a rumour or organizing to ignore or exclude the other" (p. 43).

Research by Adler and Adler (1998) on peer power relations shows that sociologically popular children use bullying (coercion, intimidation, ridicule, and assault) specifically to increase group solidarity and strength, "[t]urning people against an outsider served to solidify the group and asserting power of the strong over the vulnerability of the weak" (Adler & Adler, 1998, p. 65.). Adler and Adler continue:

> Getting picked on instilled outsiders with fear, grinding them down to accept their inferior status and discouraging them from rallying together to challenge the power

> hierarchy. In a confrontation between a clique member and an outsider, most people sided with the clique member. They knew that clique members banded together against outsiders, and that they could easily become the next target of attack if they challenged them. Clique members picked on outsiders with little worry about confrontation or repercussion. They also knew that their victims would never carry the tale to teachers or administrators (as they might against other targets…) for fear of reprisal. As Mike, a fifth-grade clique follower, observed, "They know if they tell on you, then you'll 'beat them up,' and so they won't tell on you, they just kind of take it in, walk away."

Adler and Adler describe an act of ostracism among some fourth-graders, where individuals actually left their school due to effective coalitional exclusion (1998, p. 64):

> Diane recalled the way she turned all the members of her class, boys as well as girls, against an outsider: "I was always mean to people outside my group like Crystal and Sally Jones; they both moved schools. … I had this gummy bear necklace, with pearls around it and gummy bears. She [Crystal] came up to me one day and pulled my necklace off. I'm like, 'It was my favorite necklace,' and I got all of my friends, and all the guys even in the class, to revolt against her. No one liked her. That's why she moved schools, because she tore my gummy bear necklace off and everyone hated her. They were like, 'That was mean. She didn't deserve that. We hate you."

Most of the research just described focused on children and teenagers in Western school

populations. The large number of psychological studies looking at indirect-, relational-, and social-aggression (discussed in the next section; see Archer, 2004) also included mostly young Western subjects. One example among somewhat older females, still in a Western population, comes from Laidler and Hunt (2001), who observed of female gangs in the San Francisco Bay Area:

> As in Lees' study of English girls (1997), we find gang girls spending a great deal of energy 'bitching' or casting doubt on others' reputations. This cross-cultural process operates not only as a mechanism of social control, but also of distancing and confirming one's own reputation.

Describing gossip among adult members of a small community in the Central Pacific who speak a dialect of Polynesian Tuvaluan called Nukulaelae, Besnier (1989) wrote, "In order to create a successful gossip session, gossips must ensure that their audience shares their own feelings and attitudes toward the specific topic of the gossip" (p. 320). Besnier points out that gossip among the Nukulaelae is more commonly a female than male activity. Besnier argued that collusion was a main feature of gossip among the Nukulaelae, and discussed how gossipers delayed the introduction of key elements of a story so that their listeners took an active role in the co-production of gossip. The coalitional, strategic use of gossip requires that coalition members agree on their interpretations of, and attitudes toward, reputation-relevant information. This shared co-production strategy might help the main gossiper avoid retribution for gossiping by diffusing the responsibility of the information transference to others (i.e., "I didn't

damage so-and-so's reputation; everyone did"). Along these lines, research among Western adolescents by Eder and Enke (1991) found that a supporting response to an initial negative gossip statement about another caused other conversation participants to subsequently make only negative comments that were in agreement with this evaluation (early challenges to the evaluation, which were relatively infrequent, led to less conformity). Gottman and Mettetal (1986) similarly found that four-and five-year-olds gossip in a process leading to extremes in opinions against the discussed party, creating an atmosphere of "we against others."

Human dominance hierarchies are based on more than just physical fights

The socioecological model emphasizes that monopolizable resources select for coalitions and also for dominance hierarchies. Dominance hierarchies (Schjelderup-Ebbe, 1922), found in a wide range of group-living primates and other taxa (Bernstein, 1981a, b; Silk, 2007a,b), are characterized by a consistent outcome in agonistic relations (Drews, 1993); that is, when two animals contest a resource, the one with higher rank in the hierarchy almost always obtains the resource without a fight. Dominance hierarchies are thought to have evolved for the mutual benefit of avoiding the cost of a fight (Maynard Smith & Parker, 1976). In some cases, dominance rank is determined by observable qualities, such as age, sex, and body size. In others, however, it might be determined by the outcomes of previous interactions, in other words, by the animal equivalent of individual reputation (e.g., Drews, 1993). Maintaining or increasing rank in primate societies often requires allies (Harcourt and de Waal, 1992; Chapais, 1996; Silk, 2007a).

In a typical example, allies will intervene on behalf of kin in a conflict against an unrelated, lower ranked group member.

Female dominance hierarchies are common in animals, including non-human primates (van Schaik, 1989), elephants (Archie, et al., 2006), hyenas (Holekamp, et al., 1997; Owens & Owens, 1996), and mongooses (Creel & Waser, 1997), yet the study of dominance in humans has focused on males, perhaps as an artifact of a focus on physical coercion (Hawley et al. 2008). When indirect aggression and prosocial behavior are considered, however, dominant females and males appear remarkably similar. Based on recent studies, Hawley et al. (2008) conclude that despite some sex differences in dominance, across all age groups the most dominant members of a social group are both female and male, and that the aim of achieving dominance is resource control. They further conclude that high dominance females and males are attractive to others, typically have high centrality in social networks, and are often bi-strategic, using both indirect aggression and prosocial behavior to attain and defend dominance (see also Henrich & Gil-White, 2001).

Turning to the ethnographic record, high ranked individuals in small-scale societies, such as headmen and chiefs, often obtain their (limited) authority, in part, on the basis of their munificence (e.g., Lowie, 1948). Such prosocial behavior is probably important in achieving dominance among humans because many of the valuable and monopolizable social and material resources that are important to individual fitness must be obtained from other people.

In summary, whereas animal dominance hierarchies are usually grounded in fighting abilities, human dominance hierarchies are grounded in both aggressive abilities and a

reputation for being able to provide valuable benefits to others. To maintain or increase rank in human societies, it is therefore often necessary to increase one's reputation for providing valuable benefits, or to decrease the reputations of one's competitors. Importantly, highly dominant females and males both appear to have numerous allies insofar as they are often the most popular, most liked, and most central members of their social networks (Hawley et al., 2008 and references therein).

Sex differences in physical aggression

Archer's 2004 meta-analysis looked at sex differences in aggression types in a large number of studies. With regard to physical aggression, 124 studies yielded a very consistent, large male bias in physical aggression across cultures. This bias appears at or before the age of two, and does not increase with age during childhood. He also found that the maximum sex differences in physical aggression occur well after puberty, between 18 and 30 years of age. Physical aggression appears to be linked to upper body strength, which is highly sexually dimorphic, probably due to sexual selection in males (Sell, Hone, & Pound, 2012).

Archer (2004) also looked at indirect aggression in 61 studies. He found that the female bias increases with age from six to 17 years, reaching a peak between 11 and 17 years. He found little evidence of a behavioral sex bias among adults, and in the few cross-cultural studies of indirect aggression reviewed, there was no sex bias, or a female bias. One limitation of Archer's meta-analysis is that it only reported sex differences in aggression, not absolute levels of aggression, so it is not clear if absolute levels of indirect aggression peak during this age range.

The sex difference in indirect aggression peaks at puberty, suggesting the role of sexual selection (Campbell, 1995; see also Geary, 1998). Why should female aggression peak earlier than male aggression? I argue that, just as physically aggressive behavior in males should peak at the ages at which males would have been competing for mates in the ancestral environment, indirect aggressive behavior should peak in females at the ages at which females would have been competing for mates in the ancestral environment (Hess & Hagen, 2006b). Worldwide, women tend to marry at younger ages than men – in less well-developed regions, the average age at first marriage for men is 24.9, and for women, 21.4. In the 15-19 year-old age category, over five times as many women are married (14.7%) as men (2.6%) (unweighted averages across 199 and 191 countries and regions, respectively; data from UN 2000). It is conceivable that in the ancestral environment, an even greater fraction of women and an even smaller fraction of men in the 15-19 year-old age category would have been married. Female intrasexual aggression, if related to mating, should therefore peak earlier than male intrasexual aggression. In addition, girls begin and complete puberty earlier than boys (Mouritsen, et al., 2013). Further, many first marriages in the ancestral environment would have been arranged by parents and other senior family members. In order to influence the decision-making of these parties, young women might have had to spread negative gossip about competitors. Consistent with this, the female bias in indirect aggression is greatest among 11-17 year-olds, and the male bias in physical aggression is greatest among 18-30 year-olds (Archer, 2004). Nonetheless, most women compete for mates into their 20s and beyond to retain mates or in order to switch to new mates.

The conclusion of most studies, then, is that men physically aggress much more than women across all ages, but the sexes indirectly aggress equally often, with a possible female bias only in adolescence. Given that females in many non-human animals, including non-human primates, frequently engage in physical aggression, the evolutionary conundrum is why women rarely engage in physical aggression. Several hypotheses have been advanced.

Campbell (1999) argued that physical aggression is less common among women than men because maternal care is more crucial to female inclusive fitness than paternal care is to male inclusive fitness. When conflicts arise, women cannot afford the high costs of physical aggression, and instead engage in indirect or low-level direct combat such as negative gossip (Campbell, 1999; Archer, 2009). However, non-human female mammals all face the same high costs, yet often engage in physical aggression.

Gossip is better than physical aggression for within-group competition

Another potential explanation for women's avoidance of physical aggression is that, whereas between-group competition emphasizes physical formidability and is arguably more important for males, within-group competition emphasizes reputation and is arguably equally important to females and males. For within-group competition, indirect aggression is superior to physical aggression. Within-group physical aggression entails the risk of injuring a fellow group member. Although physically harming a competitor might increase one's access to a resource, injuring a competitor also reduces the benefits that competitor can provide to other group members, such as goods and services, protection from predators, and military strength. Physical aggression also puts the

aggressor at risk of injury, similarly reducing the benefits he or she can provide to other group members. Further, physical aggression within groups can undermine a group's ability to compete with other groups. Aka hunter-gatherers, for instance, view physical aggression as one of the worst acts an Aka can do (Hess, et al., 2010). Knauft (1991, p. 13) notes that in hunter-gatherer groups, "interpersonal aggression and violence tend to be unrewarded if not actively devalued by men and women alike." Thus, women and men would be discouraged from physically aggressing against fellow group members.

In contrast, gossip can be important information that is sought after by group members. People want to know about people that they are or will be in exchange relationships with, and importantly, they are going to want to know both positive and negative attributes about those people. Gossip, whether it reflects negatively or positively on its subject, can *benefit* other group members—people *want* to know accurate information about members of their group. Thus, gossip about community members, even negative gossip, should be discouraged much less than physical aggression toward community members. Gossip, even negative gossip, should be discouraged less than physical aggression is, at least when the competition is within groups.

In addition, whereas physical aggression would harm an individual's ability to provide benefits to others in multiple domains (e.g., one's ability to forage *and* one's ability to engage in intergroup conflict), gossip can be more specifically tailored to serve a targeted, strategic, competitive end. Gossip allows an individual to harm a competitor in one domain (e.g., her mate status) while sparing her well-being in other domains (e.g., her ability to care for a sick family member, to gather water). With gossip, one can limit a competitor's *access* to desired resources, thereby increasing one's own access to those

resources, without limiting that competitor's ability to *provide* resources to other community members; this makes gossip a good weapon for within-community competition.

A final potential account of why women engage in less physical aggression than men is related to human pair-bonding: most adult females have close ties to an adult male. In humans, men are physically much more physically formidable than women (Pheasant, 1983). If a woman physically aggressed against another women, this might bring her into conflict with that woman's spouse, who would almost certainly prevail in a physical conflict. Hence, female-female physical aggression might quickly become a fight between the husbands.

Sex differences in indirect aggression

Most studies have not found a sex difference in self-reported indirectly aggressive behavior, with perhaps a small female bias in late adolescence and none in adults (Archer, 2004). However, in a scenario study involving conflict with a same-sex competitor, and employing both forced choices and Likert scale ratings of desires to retaliate, Hess and Hagen (2006b) found clear evidence of sex differences. In the forced choice paradigm, significantly more women expressed a *desire* to retaliate with gossip (90%) than with physical aggression (10%), whereas men were about evenly divided in their desire to retaliate with gossip (55%) vs. physical aggression (45%); controlling for social norms and approval, the odds of a woman retaliating with gossip was 14.22 times higher than that of a man. In the Likert scale ratings, women expressed significantly

stronger desire to retaliate with gossip than did men (moderately large effect, Cohen's *d*=-0.39).

In addition, men's desire to retaliate with gossip was more strongly influenced by perceived social norms against gossip than was women's: even women who thought it was wrong to gossip had a strong desire to gossip, whereas men who thought it was wrong to gossip did not desire to retaliate with gossip. Finally, these differences could not be explained by sex differences in social norms against gossiping or physical aggression because, although social norms did have a strong influence women's and men's retaliation strategies, there were minimal sex differences in perceived social norms against gossiping. Thus, even though there does not appear to be much of a sex difference in gossiping behavior (if any), there does appear to be a clear sex difference in gossiping psychology.

Another limitation of most studies of adult aggression is that they utilize self-reports, and are often conducted in Western populations. In a study of physical and indirect aggression in Aka hunter-gatherers of the Central African Republic that used peer-ratings of aggression, Hess, et al. (2010) found that, after controlling for peer-rated anger, Aka women had higher peer-ratings of indirect aggression than men. Most studies of sex differences in aggression do not control for anger.

The foregoing results need to be replicated in other populations. Nevertheless, they indicate that sex differences in indirect aggression among adults might be important. If so, it is worth speculating about possible explanations. Indirect aggression is a strategy that is used by both sexes. Sex differences in the use of this strategy could occur for a number of reasons, including that the benefits of the strategy are higher for one sex, or

the costs lower; that one sex more frequently finds itself in situations that evoke indirect aggression; or that competitors of one sex are more easily harmed by indirect aggression.

As discussed earlier, women may engage in less physical aggression than men for several reasons. A separate question is, "Why might women use more indirect aggression than men?" Campbell (1999) suggested that women engage in more indirect aggression because it is a safer alternative to using physical aggression. Moreover, the "indirectness" of tactics like gossip separates the aggressors from their harm, meaning the possibility of the aggressors being detected is lower, and so the possibility of the aggressors being retaliated against is lower. In contrast, with physical aggression the identity of the aggressor is known, so harm from retaliation is more likely. This safety is especially important for vulnerable pregnant women, and women with dependent offspring. This hypothesis for why women use indirect aggression is reasonable, but it does have shortcomings. First, the argument should also apply to males: in female-female competition, the danger is that the victim is vulnerable because she cannot incur to fitness costs of injury inflicted by another female. However, in male-male competition, a male is also particularly vulnerable because of the fact that his *male* opponent is well-equipped to inflict severe physical harm. Losing a fight to a male might not harm dependent offspring, but it is more likely to inflict substantial damage. Second, the absence alone of one strategic option is not necessarily an argument in favor of one particular argument among multiple potential alternative arguments. Why use indirect aggression rather than physically harming or doing away with a competitor in a secretive or long-distance manner, such as using slow-acting poison or setting dangerous traps? Third, indirect aggression does not guarantee the aggressor will go undetected. Gossips can be identified

and punished. For example, Among the Ashanti, gossiping against powerful individuals was punished by cutting off the perpetrator's lips (Stirling, 1956; cited in Fine & Rosnow, 1978). Fourth, as discussed earlier, among female nonhuman primates, whose physical welfare is crucial to reproductive success, physical contests are in fact common, evidenced in in part by the prevalence of female dominance hierarchies. A recent example from the popular press describes the fights and injuries that erupted among female baboons at the Toronto zoo, prompting a brief closure of the zoo's exhibit: "Brutal baboon battle erupts for throne at Toronto Zoo after matriarch dies: Medical records show injuries ranging from deep lacerations near their eyes to hair ripped out and tail injuries (Liam Casey, The Canadian Press, 11/29/15, the Toronto Star.)

Perhaps, then, women and girls engage in indirect aggression not because it is a safer alternative to physical aggression, but *because it is particularly effective at harming a female competitor*. One way in which gossip, ostracism, and other forms of indirect aggression might be more harmful to women than men was proposed by Geary (1998, p. 250), who suggested that indirect forms of aggression "disrupt" the reciprocal relationships of unrelated female competitors. Disrupting social relationships and inducing stress has been shown to reduce fertility in other primates (Abbott, 1993; Smuts & Nicolson, 1989; cited in Geary, 1998), and it may be the case that women disrupt social relationships and induce stress in other women as a form of reproductive competition (Geary, 1998, p. 137-138). Geary's proximate account for why women use more indirect aggression involves hormonal attributes that women possess and men do not.

Another reason why women and girls use indirect aggression more than men and boys was suggested by Proveda (1975, p. 133), who pointed out that reputation has different meanings for males and females:

> Reputation may be regarded as a function of both a person's actual behavior and of the information distribution about the person. It is suggested that in the girl's social system, reputation is achieved (or lost) largely through the manipulation of information about people. In the boys social system, earning a reputation is much more a function of actual behavior.

Proveda continues (1975, p. 133):

> [T]he boys are not so vulnerable to this secret and sometimes vicious manipulation of information about persons since their behavior may be *publicly* tested. The behavior and social identities that are rooted in being a good athlete, a good fighter, or a good student may be relatively easily confirmed or refuted. On the other hand, how is it possible to test whether one is a “slut” or a “whore”?

This reasoning was also alluded to in a quote by Campbell (1995, p. 115):

> One teenage girl…remarked that ‘a girl that's been called a slag is the same as a boy that's been called a chicken,’ and indeed from the viewpoint of future reproductive success their impact is similar. A male can demonstrate that he is

not a chicken by fighting anyone who impugns him. A girl, however, is unable to demonstrate in any convincing and public way that the accusation is false. Her best hope is to successfully repel anyone who so accuses her and thus minimize the chance of anyone else repeating such a reputational attack.

Here is a breakdown of the logic underlying Proveda and Campbell's observations that female reputations are more vulnerable to misinformation:

1. It is difficult to disprove false gossip when relevant information is hard to come by.
2. Information about some dimensions of reputation can be hard to come by because:
    a. collecting relevant information can be time consuming (assessing someone's relative vulnerability to infectious disease, for example, would require observations over months or years);
    b. collecting relevant information can be risky (for example, 'spies,' if caught, are often subject to punishment, and 'nosey' people are often avoided and/or disliked);
    c. relevant information can often be actively concealed; extramarital affairs, for example, are difficult to investigate;
    d. relevant information may be available only to certain individuals who are unwilling to share it;
    e. and, once obtained, it is often necessary to process relevant information in order to determine how it impacts on a person's reputation; this processing can be time-consuming and may require considerable additional background information.

3. Dimensions of reputation that are difficult to confirm are therefore more vulnerable to false gossip than dimensions that are easy to confirm.

4. Compared to men, a greater fraction of female reputation depends on difficult-to-confirm dimensions of reputation.

5. Women are therefore more vulnerable to false gossip than are men.

6. Gossip is therefore a more effective competitive strategy for women than men.

The key premise of this sex difference argument is step four. Although many aspects of male and female reputation are equally important and equally easy- or difficult-to-confirm (such as political abilities, medical abilities, kinship ties, etc.), in ancestral environments, some important but difficult-to-confirm dimensions of male and female reputation arguably constituted a greater fraction of female reputation than male reputation: fertility, fidelity, childcare ability, and ability or intent to cooperate with affines (relatives by marriage rather than shared biological descent).

There is a large sex difference in the minimum level of parental investment. Due to the fact that women get pregnant and men do not, women's reproductive capacity is a valuable and limited resource over which men compete. In addition, especially in societies characterized by alliance-by-marriage, parents and other authority figures also seek to influence and control women's reproductive choices. Consequently, if a woman's reproductive ability is reduced (e.g., premature infertility), or if she uses it in socially disapproved ways (e.g., infidelity), these could have imposed substantial fitness costs on her husband, family, in-laws (likely a significant fraction of the community she married

into), and any other community members benefiting from any alliances that were solidified by her socially-approved marriage.

In contrast, although a man's infertility is costly to him, his wife could have often married another group member—perhaps a brother—and no one *else* would have suffered a fitness cost (there is little competition over men's sperm). Philandering by a man would also not necessarily impose a cost on his wife and family members unless he also expended resources to obtain extra-pair mating opportunities and/or invested in the socially disapproved offspring. Sex differences in parental investment, then, might explain why fertility and fidelity are more important dimension of female reputation than male reputation.

Compared to men, women's willingness and ability to invest in offspring, including gestation, lactation, and other critical forms of direct care, also had a larger impact on offspring survivorship. Men may have had a greater variance in their willingness and ability to invest in offspring than women (see La Cerra, 1995), but it is not the amount of variance in child investment that matters. What matters is the effect that variance has on the outcome, which is child survivorship. Whereas mothers might have an ability to buffer unpredictability in male parental investment, fathers simply could not buffer variance in, for example, a mate's willingness to nurse a child. Consequently, ability and willingness to parent should be a more important determinant of female reputation than male reputation.

Female exogamy—the practice of women marrying outside the tribe, family, clan, community, or other social unit or group—is much more common than male exogamy in contemporary small-scale societies, including hunter-gatherer societies (c.f. Marlowe

1999). Data from the Ethnographic Atlas show that 69% of societies studied practice female exogamy (Rodseth, et al., 1991, p. 230; Murdock, 1967), a pattern supported by genetic data (Seielstad, Minch & Cavalli-Sforza, 1998; Lippold et al. 2014). Female exogamy puts exogamous women in the position of being expected to making costly economic and political contributions to group members to whom they are not biologically related. Absent kinship, exogamous women may feel disinclined to do so. Moreover, they may be unable to do so for various reasons, such as lacking sufficient resources, lacking relevant cultural knowledge or important skills, or physical limitations. When community members have not observed a new woman's history of providing valuable contributions and benefits, the woman can be vulnerable to a competitor's misrepresentations of her willingness and ability to do so. Ethnographic evidence indicates that young women marrying into a new group often face considerable social hardships and competition from resident women (e.g., Sudanese women, Kenyon, 1994; Zincanteco women, Haviland 1977, 1988; Yanomamö women, Valero, 1965; and Peters, 1998; and women in gangs, Campbell, 1995). For example, Haviland (1977, p. 188) described gossip among Zincanteco Indians from highland Chiapas as a form of within-group competition, "[a] new bride, introduced to her husband's household, represents a serious potential breach of confidentiality; her in-laws begrudge her to even occasional visits to her own mother, where she can leak out family secrets and gossip about her new household to an outsider." Haviland later discusses how a newly-married woman's unmarried, co-residing sisters-in-law can "make life unbearable for a young woman who has never before lived away from her own hearth," a young woman whom they view as "incompetent and an intolerable spy in their midst" (Haviland, 1988, p. 417). Female 'exogamy' can also

result from raiding. Peters (1998, pp. 116-117) described the experiences of recently-kidnapped Yanomamö women in their captors' village: "Other women will belittle her for non-Xilixana behavior or her peculiar accent. Her status improves with time, after she integrates and bears children." Helena Valero, a Spanish woman kidnapped by a Yanomamö group when she was a child, provided a first-hand account of the conflict engendered by wife capture (Valero 1965, p. 44):

> Every woman of the shapuno said to her husband's female prisoner: 'Now you'll do as I say. You'll have to go gather wood for me, and water in the igarape for me. If you don't do it, I'll beat you.' One woman replied, 'I came because your husband brought me; I should have run away at once.' The husband said: 'Stop talking, else I'll give you both a beating.' The wife went on: 'No, I will kill her and then you will burn her by yourself; I will run off with other men.

When female exogamy and polygyny—the marrying of one man to multiple wives—occur in concert, female-female competition and conflict among affines is compounded. Young women entering groups with polygynous mating systems can face especially strong competition with unrelated co-wives, their children, sisters-in-law, and others. For example, Shostak (1981, p. 170) writes of tension among Ju/'hoansi co-wives, "Many become furious when their husband suggests [polygyny]. They claim that sexual jealousy, rivalry, subtle (and not so subtle) favoritism, and disputes over chores and other responsibilities make the polygynous life a very unpleasant one." Senior wives appear to have the upper hand in these competitions. Shostak quotes a Ju/'hoansi woman

discussing her position in a polygynous marriage, “I am in the stronger position because I am older and because I married our husband first...I can tell my sister to get water, but she never tells that to me.” Shostak reports that senior wives had the power to make the lives of a new co-wife and the husband miserable to the point that the new wife opted to leave the marriage. Senior wives also appear to have more children and healthier children than junior wives in small-scale, polygynous societies (e.g., Daly and Wilson, 1983, as cited in Geary, 1998, p. 250; Hagen, et al., 2001; Sellen, 1999; Strassman, 1997). The benefits of seniority may result from demonstrated success in providing one’s affines and other community members with reproductive, economic, and other benefits. I would posit that senior wives also reap benefits from memberships in well-established coalitions with other women, perhaps in the domain of informational warfare.

To summarize, fertility, fidelity, childcare ability, and ability or intent to cooperate with affines were probably equally difficult to ascertain for both sexes. However, these qualities in women were arguably more important to most other community members than the same qualities in men because male reproductive capacity (i.e., sperm) was cheap and easily replaced, because male childcare was less important to offspring survivorship than female childcare, and because male-male cooperation was probably facilitated by within-group kinship (due to males less commonly leaving their natal communities at marriage). Fighting and hunting ability might have been more important determinants of male reputation than female reputation. However, fighting and hunting were relatively easy to assess, and thus less vulnerable to inaccurate gossip. When challenged, a man fights and wins or he loses; a man regularly comes home with game or he does not. Of course, information about fighting and hunting ability will be

gossiped about, but inaccurate gossip can be easily corrected. The unequivocal evidence that would be needed to disconfirm false accusations about a female's fertility, fidelity, childcare ability, and intent to cooperate with new in-laws can be difficult or impossible to acquire.

I suggest one final reason for why women and girls might use indirect aggression more than men and boys: women and girls might have faced more within-group competition than men and boys because women were more often exogamous than men (Lippold et al. 2014) and thus had the challenge of integrating into new groups of non-kin (Hess, 2006). Further, as argued earlier, gossip is a better within-group competitive strategy than physical aggression. If gossip were a better within-community competitive strategy than physical aggression, and if female exogamy (*or anything else*) caused women to face more within-community competition than men, then ancestral women may have been under stronger selection than ancestral men to aggress against same-sexed others with gossip.

Within-coalition Dynamics: The Role of Reciprocity in 'Friendship'

In critiquing evolutionary accounts of human friendship that have assumed reciprocity explains much of human 'friendship' among nonkin, Silk (2003) discusses evidence distinguishing between exchange relationships and communal relationships. In exchange relationships, individuals give benefits to strangers or casual acquaintances with an expectation that comparable benefits will be returned. In communal relationships, which tend to occur in close friendships and among kin, benefits are given when needed, and there is no obligation for reciprocity. Studies show that immediate, short-term, Tit-

for-Tat-style exchanges are more characteristic of exchange relationships than communal relationships. These findings call into question the role of reciprocity in deeper, communal relationships. Shackelford and Buss (1996) defend the role of reciprocity in close friendships. Silk summarizes their argument, but then dismisses it:

> Shackelford and Buss (1996) suggest that the difference in the dynamics of reciprocity in communal and exchange relationships reflects differences in the timescale over which accounting is done. According to their view, in coalitions and exchange relationships, the shadow of the future is short, and immediate reciprocity is required to prevent exploitation and cheating. In communal relationships (such as close friendships), the shadow of the future is extended, and there is more tolerance of short-term imbalances in relationship accounts. In such cases, insistence on immediate reciprocity signals uncertainty about the continuation of the relationship, and thus elicits feelings of concern, distress, or betrayal. They hypothesize that the difference in responses to requests for immediate reciprocation by close friends and coalition partners…arises because a demand for immediate reciprocity implies that future interactions are unlikely to occur. This is more disturbing for close friends, and elicits stronger feelings of betrayal, than for coalition partners. Although this explanation might explain why friends avoid Tit-for-Tat reciprocity, it does not explain why they obscure their contributions to joint tasks with friends (2003, p. 47).

Silk concludes that the function of close, cooperative relationships with non-kin, such as close friend, remains an unsolved puzzle.

What is interesting about Shackleford and Buss' study, and Silk's take on it, is that 'coalitions' are viewed as more similar to exchange relationships than communal (or 'close friend') relationships. I believe that an alternative view of 'close friends' *as coalitions* may help to elucidate the friendship puzzle: relationships that fit the 'friends' construct function to cooperatively analyze information, particularly social and reputational information. On this view, friendships serve the goal of understanding and manipulating the social environment via the cooperative collection, analysis, and dissemination of information. One might ask, however, why close or enduring friendships serve this goal better than acquaintances or temporary allies. The answer is that close, long-term friends are able to make better use of relevant information. They are more likely to know the intentions, history, and characteristics of the people involved, the relevant background information, and the details of the current predicament as they relate to various parties. As one college sorority informant said of her closest sorority friends in an interview (Hess, 2006), "they know the people; they know the situation."

Conclusion

Humans might be a supporting data point for one general and powerful claim of the socioecological model: that, for both sexes, coalitions are useful in within-group contest competition to maintain or improve rank or reputation. I have proposed that the value of coalitions is not limited to the domain of physically aggressive competition. The coalitional manipulation of reputations might be more effective than reputational manipulation by individuals because coalitions have improved abilities to strategically collect, analyze, and disseminate information. Coalitions can do this offensively by harming the reputations of competitors, and defensively by protecting the reputations of

coalition members. In addition, information from multiple individuals may be more believable. Further, I have proposed that the benefits of coalitions are not limited to male competition. In contrast to non-agonistic theories of women's friendship (e.g., Taylor, et al., 2000), female alliances and coalitions may be beneficial in contest competition for resources when the 'weapon' is not physical aggression but reputational manipulation and other forms of indirect aggression.

Alliances and coalitions are clearly useful in alternative forms of competition not addressed here, such as ostracism, enforcement of costly group norms, and punishment. Wilson (1997) and Wilson, et al. (2004) argue that in addition to activities such as hunting and warfare, cooperation can also evolve in the context of cognitive activities, such as perception, memory, attention, and decision-making; for cognitively difficult tasks, two (or more) minds are better than one. I have applied and extended this idea to reputational competition, where one 'difficult task' is discovering the objectionable acts committed, or the undesirable traits possessed, by one's opponent. This task can be difficult because it requires observing rare events, or acts or traits that are usually concealed (e.g., few readily admit to cheating on a spouse, failing to help others in need, or lacking some essential skill). In this sense, two 'detectives' are better than one.

Coalitions can be useful for noncompetitive goals that do not involve violence or the exchange of reputation-relevant information—goals that improve manipulating the environment (such as cooperative net hunting), and goals that involve understanding the nonsocial environment (such as exchanges of hard-to-acquire information about rare food resources or medicinal plants); see, e.g., Kaplan & Gurven, 2005. Often, inferences of social and ecological conditions must be made based on fragmentary, ambiguous, and

perhaps contradictory information. Coalition members can make use of social and ecological data structures that have been processed, or partially processed, by others. Further, coalitions are likely quite valuable for improved collection and analysis of many kinds of non-social information, such as how to assemble different data collection components of a Mars lander. For additional benefits of enduring, cooperative relationships, see, for example, Smuts, 1992; Tooby and Cosmides, 1996; Hawley, 1999; and Henrich and Gil-White, 2001. These benefits notwithstanding, the improved information collection and processing is an important benefit of belonging to within-group cliques or coalitions (Wilson, et al., 2004), regardless of the ultimate use to which the processed information is allocated.

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