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Cultural and reproductive success and the causes of war: A Yanomamö perspective

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Abstract

Inter-group competition including warfare is posited to be a key force in human evolution (Alexander, 1990; Choi & Bowles, 2007; Wrangham, 1999). Chagnon’s research on the Yanomamö is seminal to understanding warfare in the types of societies characteristic of human evolutionary history. Chagnon’s empirical analyses of the hypothesis that competition for status or cultural success is linked to reproduction (Irons, 1979) and warfare attracted considerable controversy. Potential causal factors include “blood revenge”, mate competition, resource shortages or inequality, and peace-making institutions (Boehm, 1984; Keeley’s (1997); Meggitt, 1977; Wiessner and Pupu, 2012; Wrangham et al., 2006). Here we highlight Chagnon’s contributions to the study of human warfare.

1. Introduction

The causes of warfare and its intensity and frequency at different levels of social organization has received much attention from

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anthropologists. Keeley's (1997) pathbreaking survey in *War Before Civilization* assessed warfare mortality rates compiled by ethnologists, historians, and archaeologists, demonstrating that warfare was more intense in non-state social systems compared to state systems. In Keeley's work and in subsequent elaborations (e.g., Pinker, 2012), Chagnon's research has been prominently featured. In 1988, Chagnon published a study demonstrating a correlation between warrior status (*unokai*) and male fertility and marital success among the Yanomamö, stimulating numerous contentious commentaries in the media and elsewhere. This work and attempts by others to replicate the findings are crucial to Chagnon's theoretical perspective integrating cultural and biological perspectives in human behavior.

Chagnon (1989) "blood revenge" paper builds on two key findings. First, in 1979, Chagnon asked "Is reproductive success equal in egalitarian society?" and found that male reproductive variance was greater than female variance, consistent with Trivers' (1972) parental investment theory. A major point was that although there was little material or economic variance (i.e., economic inequality) among the Yanomamö, reproductive variance among males was high. Of course, high reproductive variance was associated with polygyny which suggested that one must minimally account for why some men were polygynous and others were not. Just as importantly, Yanomamö marriage was not associated with bride price or material transactions that permit wealthy men to have greater fitness in societies with economic inequality. Second, Chagnon's "blood revenge" paper was inspired by Irons' prediction (1979) that cultural success—measured in terms of achieving culturally determined high status—would be associated with higher reproductive success. Irons (1979) demonstrated this association in research among the Turkmen by showing that wealthy men had higher fertility than poorer men.

The "blood revenge" paper showed that high status was associated with being a redoubtable warrior. One indelible mark was achieving the status of *unokai*—participating in the killing of an enemy and going through the associated purification ceremony. *Unokais* had greater fertility and marital success (measured as number of wives) compared to non-*unokais* (Chagnon, 1989: p.989, Tables 2–3). Another goal of Chagnon's research was to understand the nature of revenge killing by examining the possible inclusive fitness benefits of being a culturally valued warrior (Chagnon, 1989: 986). Chagnon writes:

“... the argument that cultural success leads to biological success among the Yanomamö might be the most promising avenue of investigation to account for the high reproductive success of *unokais*. Indeed, the Yanomamö frequently say that some men are ‘valuable’ (*a nowä dodihiwä*) and give, among the several reasons, that they are *unokai*, avenge deaths, or are fierce (*waiteri*) on behalf of kin. In short, military achievements are valued and associated with high esteem, as they are in many other cultures, including our own (1988: p.900).”

He further states “...I do assume that humans strive for goals that their cultural traditions deem as valued and esteemed. In many societies, achieving cultural success appears to lead to biological (genetic) success” (1988:985). Crucially, this is not to say that achieving *unokai* status is the sole road to high status among the Yanomamö: “Some Yanomamö men are in general more responsible, ambitious, economically industrious, aggressive, concerned about the welfare of their kin, and willing to take risks. Becoming an *unokai* is simply one of a number of male characteristics valued by the Yanomamö [emphasis added] and an integral component in a more general-complex of goals for which ambitious men strive” (1988:985).

Ferguson (1989) noted a confound in Chagnon’s analysis: fertility and achieving the status of *unokai* were likely age dependent: both fertility and the probability of achieving *unokai* status increased with age and that men who had died were not counted. He also claimed that the inclusion of headman in the sample was problematic since the comparative literature in Amazonia showed that headmen were more likely to be polygynists (Levi-Strauss, 1944). But this latter criticism is misguided: being a headman is an indicator of cultural success and no man becomes a headman without becoming an *unokai* first (Chagnon, 1989). Nevertheless, Chagnon (1989) immediately responded with a reanalysis by subtracting headmen from the sample and controlling for age by comparing the fertility and number of wives of *unokai* and non-*unokai* men in the age categories of 20–24, 25–30, 31–40, and >40 (Table 1, page 586). In each age category *unokais* had higher fertility than non-*unokais* and in three of the four age categories they had more spouses. In the one age category for number of spouses that did not reach statistical significance, the *p* value was 0.0672. Even

though in this re-analysis Chagnon removed headmen which reduced the probability of finding significant associations, there was still robust support for the cultural and reproductive success model.

2. Case studies

Chagnon's "Blood Revenge" article inspired several case studies examining the link between cultural and reproductive success in egalitarian societies. Several focused on warfare, but others examined other dimensions of status as hunting ability, wealth, and political leadership. We briefly touch on some of these studies.

2.1. *Cheyenne case study: peace and war chiefs*

Moore (1990) challenged Chagnon's findings using ethnohistoric data on Cheyenne peace and war chiefs to demonstrate that war chiefs had higher mortality and lower fertility rates than peace chiefs. Moore erroneously concluded that this provided contrary evidence of the relationship between warrior status and reproductive success established by Chagnon's *unokai* study. Moore also made a general critique of evolutionary theory as a framework to account for human behavior, subsequently criticized by Dunbar (1991). Moore simplistically and erroneously claims that Chagnon posited that violence leads to high status and to high fitness in some universal sense. However, Moore claimed that what makes for high status in other groups such as the Cheyenne is culturally determined following Irons' (1979) original formulation. Moore claimed that peace chiefs had higher status than war chiefs, a position supported by other ethnographers:

"The keystone of the Cheyenne social structure is the tribal council of forty-four peace chiefs.... the supreme authority of the tribe lies not in the hands of aggressive war leaders [Moore's war chiefs] but under the control of even-tempered peace chiefs. All the peace chiefs are proven warriors, but when a chief of a military association [war chief] is raised to the rank of peace chief, he must resign his post in the military society. He retains his membership, but not his position as war chief." Hoebel (1960: 37) [All Cheyenne are required

to be a member of one of seven military societies that cross-cut band membership.]

Both Moore and Hoebel note that the position of peace chief tends to be hereditary, but for each ten-year term, peace chiefs had to be affirmed by vote from other council members. In addition, Service (Service, 1962:123) summarizing the ethnographic literature on Cheyenne status concludes “Success in war is the primary road to achievement in status.” Moore states that peace chiefs were wealthier than war chiefs and that war chiefs came from fragmented families or were orphans (Moore, 1990: 323–324). He then statistically showed that peace chiefs had greater fertility than war chiefs (Moore, 1990:327). From this information we can infer that becoming a peace chief is the apogee of Cheyenne cultural success and that they were proven warriors. Although war chiefs attained some measure of cultural success, they were culturally less successful than peace chiefs. But they were making the best of a bad situation given they were ineligible to attain the status of peace chiefs. Consequently, Moore’s case study is consistent with Chagnon’s findings by demonstrating that higher status peace chiefs achieved greater fitness than lower status war chiefs.

2.2. The Waorani case: raid participation versus killing

The Waorani were until pacification an isolated foraging horticultural people living in tropical rainforest of Ecuador economically much like the Yanomamö. Prior to sustained peaceful contact 42% of all mortality was a consequence of Waorani on Waorani killing (54% for males and 39% for females). An additional 8% of all mortality were inflicted by Quichua neighbors (Larrick, Yost, Kaplan, King, & Mayhall, 1979). The Waorani have the highest mortality rate from warfare reliably reported in any human population. Beckerman et al. (2009: 8136) note the interesting difference in Yanomamö and Waorani demography:

“... the overall Yanomamö population had apparently been growing for at least the past 2 centuries, until the malaria epidemics of the 1990s halted this growth. In contrast, the Waorani, as far as we could tell, were well along in the process of killing themselves off at the time of peaceful contact.”

Beckerman et al.'s (2009) statistically and methodologically informed evaluation of the relationship between number of raids and various measures of reproductive success provides compelling evidence that warrior status (or, in their terms, "zealousness") measured by the number of raids in which a warrior has participated, on a yearly basis, does not enhance reproductive success. Beckerman et al. tested six hypotheses, three of which are most relevant to Chagnon's findings: (1) zealous warriors had more ever-born children, (2) their children had higher survivorship, and (3) zealous warriors had more children who reached the age of 15. Warriors were divided into three classes: those who had more raids than the mean, those who had a mean greater than 0.5 standard deviation above the mean, and those whose mean was greater than 1.0 standard deviation. They conclude that "At each age interval, zealous warriors thus defined acquired fewer wives, produced fewer ever-born children, and had fewer surviving children, although the differences are not statistically significant in some age intervals. Zealous warriors also produced fewer children who survived to age 15. These results clearly indicate that as participation in raids increases, fitness decreases." (2009: p. 8134).

While Beckerman et al.'s results are solid and impressive the study has three problems for comparison with Chagnon (Chagnon, 1989). First, Beckerman et al.'s study defines warrior status differently than Chagnon. Warrior status for Chagnon is simply whether a man has participated in a killing, but for the Waorani it is the number of raids a warrior has participated in. These measures are likely correlated because the more raids a Yanomamö participates in the more likely he is to make a kill. Second, Beckerman et al. do not establish the relationship between degree of warriorhood or zealousness and high social status although Waorani research by Boster, Yost, and Peeke (2008) suggests a weak association between zealous warriors and status. The motivation for warrior behavior may be more born of need than an indication of status. The third problem is that the comparative approach used tends to diminish the impact of the least zealous warriors on the dependent reproductive variables examined. For example, zealous warriors 0.5 and 1.0 standard deviations below the median are not compared to those at the same degree above the median. A more comprehensive approach would be to classify all males into those classes ranging from -1.0 below the mean up to 1.0 above the mean at 0.5

steps. Nevertheless, it is probably the case that more aggressive Warani warriors have lower fitness than less aggressive warriors.

2.3. The Nyangotom case: raiding for cattle “stock rights”

Glowacki & Wrangham, (2015) directly tested Chagnon’s finding on warfare participation, status and reproductive success among the Nyangotom, a pastoral people of Ethiopia and neighboring Sudan. Through interviews, 91 warriors were ranked from high to low in terms of how prolifically they raided. Initially, they found no relationship between raiding frequency and number of wives or children. They then analyzed high and low raiding elders who had retired from raiding and compared prolific versus non-prolific raiders and found that prolific raiders had significantly more wives and children than non-prolific raiders. The connection between raiding and wives is that cattle are required for bride price and prolific warriors in their youth acquired more cattle “stock rights” through their more frequent cattle raiding activities which allowed payment of bride price for multiple wives. Success in raiding is the more appropriate assessment of status.

2.4. Jivaroan cases: warriorship and attractiveness

Jivaroan groups (Achuar, Huambisa, Aguaruna, and Schuar) of the tropical forests of Ecuador are similar to the Yanomamö in terms of subsistence and environment. They also engaged in chronic warfare with approximately 30% of all mortality from warfare and 60% for males (Keeley, 1997:90). There is suggestive data from Jivaroan groups that war leaders are more reproductively successful than others and more attractive as mates (Redmond, 1994) but evidence provided is not statistically convincing even though the claim may be accurate.

In a mixed Achuar and Quichua settlement, Escasa, Gray, and Patton (2010) examined the relation between attractiveness as a potential mate and several highly regarded status attributes including being a good hunter and warrior. Photographs of males in the village were presented to men and women and they were asked to rate each on several social traits. A bivariate correlation found no correlation between warriorship and attractiveness ($r = -0.078$, $N = 29$, $p = .687$), but an additional bivariate correlation showed that warriorship rating

increased with male age ($r = 0.569$, $N = 29$, $p = .001$). After controlling for male age, warriorship was significantly correlated with attractiveness ($r = 0.517$, $df = 26$, $p = .005$). They conclude “Thus, warriorship was a strong predictor for attractiveness after age was controlled. These results provide support for females preferring a mate who is rated as a good warrior” (2010:197).

2.5. US case: WWII medal of honor recipients

The final case considered here is a study comparing the fertility of WWII veterans (Rusch, Leunissen, & van Vugt, 2015). At the time of publication, there were 464 Medal of Honor Recipients from WWII. Of these, 198 survived combat and of this subset, Rusch et al. (2015) obtained fertility data on 123. Compared to a control sample of 449 regular veterans, they found that the 123 Medal of Honor winners had greater fertility.

2.6. Additional cultural correlates of reproductive success

In hunting and gathering societies, good hunters achieve high status because they provide meat, which is a dietetically important food resource, and demonstrate their ability to invest in wife and offspring (and to share with local group families). Smith (2004) examined the relation between hunting ability and reproductive success among five hunting and gathering societies. He found that good hunters had higher fertility, married earlier, and had more surviving offspring than average hunters. Gurven and Von Rueden (2006) expanded on Smith’s study by adding five more case studies with the same results. Von Rueden and Jaeggi (2016) examined the relationship between status and reproductive success in 33 societies. They found a positive correlation between status and reproductive success regardless of economic formation (hunter-gatherers, horticulturalists, and agriculturalists). They noted, following Irons, (1979) formulation, that the relation held regardless of the culturally determined status measure (hunting productivity, physical formidability, material wealth, or political influence) demonstrating that men who achieved culturally-prioritized status had the highest fitness.

From these studies and others, there is solid evidence that males who attain culturally-defined high status—whether it be from hunting,

warriorship, or wealth—tend to have greater fitness than those lower in local status standards. This relation holds for politically stratified societies as well (Betzig, 1986). It is interesting to note that there have been no negative commentaries of findings between locally defined status and fitness except when status is indexed by warriorhood. The negative reaction to Chagnon's results may stem from an ideological objection to viewing culturally honored violence towards enemies as a path to cultural success.

3. Causes of warfare in egalitarian society

Given Chagnon's detailed and theoretically informed accounts of Yanomamö warfare and its high visibility, it should not be surprising that his work has been heavily scrutinized. The Yanomamö are the largest tribal population whose political affairs are largely outside the control of state institutions. They number more than 28,000 spread over 200 villages in the borderlands of southern Venezuela and northern Brazil. They exemplify what the philosopher Hobbes called a "state of nature" such that each village was completely free to make war or peace with neighbors, an attribute that characterized humanity until about 6000 years ago. In general, Chagnon argued that disputes over women and revenge for a previous killing or affront are the major causes of Yanomamö warfare (Chagnon, 2012). And of course, a revenge killing often is a consequence of a mortal fight over a woman.

3.1. Productive, not reproductive goals

The first counter to Chagnon's claim that Yanomamö warfare was over reproductive resources came from anthropologists including Gross (1975) and later Harris (1974, 1984). They argued that the Yanomamö and many Amazonian groups were fighting over hunting territories because of the difficulty of obtaining high quality dietary protein. Chagnon was not opposed to resource competition models of war (Chagnon, 1990). To colleagues he would jokingly say that "Harris' theory had guts but lacked balls." He maintained that competition over reproductive resources had been ignored. Still, material resource competition was a perspective he believed had merit and was a compelling explanation of warfare in places such as Highland New Guinea where the

population density ranges from 20 to 200 people per square kilometer whereas among the Yanomamö it is less than 1 person per square kilometer. Chagnon and Hames (1979) study of animal protein consumption among the Yanomamö and other Amazonian groups demonstrates that Yanomamö on average, consumed as much animal protein as modern North Americans. To be sure, documentation of ample and easily acquired protein consumption was not a conclusive refutation of the protein hypothesis given there are other ways of testing the proposition. But given the dietary data and geographic patterns of Yanomamö violence, Chagnon and collaborators decided to not pursue the matter further, they had other research projects to accomplish. There are no published data supporting the protein hypothesis in Amazonia; hence long-time Yanomamö ethnographers uniformly reject the protein model (e.g., Lizot, 1977; Albert, 1990; Kopenawa & Albert, 2013; Alès, 2010; Peters, 1998). Instead they argue that in general, Yanomamö warfare is a matter of revenge.

3.2. Access to trade goods

Ferguson (1995, 2015) introduced a new explanation of Yanomamö warfare involving access to trade goods such as steel axes and machetes that the Yanomamö cannot fabricate or easily acquire through trade. These implements make economic life more efficient and secure. Because access to these goods is limited to main waterways where, for example, missionaries site their settlements, Ferguson argues that villages fight one another for access to prime trade locations. This model has been productively used to explain increases in warfare on the American Great Plains with the introduction of horses and guns (Hames, 2019). But there is a serious methodological problem in Ferguson's historical explanation of Yanomamö warfare known as "tribal zone theory" which claims that tribal warfare increased in intensity with contact from outsiders (Ferguson, 1992), especially European colonists as consequence of "disturbances" to traditional life. Our historic knowledge of Yanomamö warfare is based on the reports of anthropologists, government officials, explorers, missionaries and pioneers. All outsiders possess industrial goods the Yanomamö desire, and outsiders frequently trade these goods to establish friendly relations. If an outsider reports warfare, then, Ferguson (1995) concludes, that war was a consequence of establishing prime access to

goods possessed by outsiders. Often absent from Ferguson's accounts is whether the outsiders documented the existence of warfare prior to their arrival or spoke of an increase in warfare after their arrival.

Ferguson (2015), following his mentor Marvin Harris, makes a distinction between emic and etic accounts of war. According to Ferguson "An etic approach to war ... frames it in terms of theory developed by outside analysts, in terms of factors and patterns which are potentially generalizable across different cultures." (2014:379). In contrast, emic accounts are culturally specific explanations and descriptions of events, practices, values, and beliefs that make sense within a culture. While emic explanations may or may not be empirically true (e.g., an enemy shaman causing a death), emic explanations are nevertheless used by members of a culture as rationales and motivations for war (or any other activity or practice). Ferguson argues that Chagnon and other Yanomamö ethnographers are using Yanomamö accounts of warfare that mask the scientifically accurate etic explanation of Yanomamö warfare over trade good or prime trading spots. As noted above, all researchers who have studied Yanomamö warfare argue that revenge is the chief motivation for war, a minor exception being Peters (1998), who notes that for a brief period, trade goods motivated Yanomamö warfare in the area of his study. For Yanomamö ethnographers, a raid is a response to witchcraft, an insult, previous violent killing, failure to realize a promised marriage, or other affront meriting deadly vengeance. More broadly, a survey by Walker and Bailey (2013:31-32) of warfare in 11 lowland South American egalitarian societies using a sample of 238 instances of lethal raiding found that revenge accounted for 70% of the reasons for going to war. Raiding for women came in at second at 18%. "Theft of material goods" accounted for only 2%.

Study of marriage by capture (or bride capture, bride theft) or the abduction of women for marital partners has a long history in anthropology (Barnes, 1999; McLennan, 1865). Chagnon documents abduction of women numerous times (Chagnon, 2012: 13, 35, 89, 90, 93, 128, 155, 170, 173, etc.). In a preliminary analysis of 8 villages, Chagnon (2012: 90) calculated that on average 11.7% of all married women had been forcibly married through abduction by men from other villages. But abductions rarely occur in the context of a raid. The goal in a revenge raid is to kill an enemy in another village and immediately retreat without loss to the raiding party. Having an abducted

woman would slow the retreat. However, if raiders believe they can safely abduct, they will do so. Abductions most often occur when visitors or their hosts decide they have the upper hand during an inter-village feast (see *nomohori* described in Chagnon, 2012: 194). Alternatively, a large group of warriors will appear unexpectedly in a small village and abduct women in front of their husbands when greatly outnumbered and cannot effectively resist.

Following Ferguson, one wonders why Yanomamö do not straightforwardly reason that raiding is designed to improve access to trade goods. There is no doubt that the Yanomamö strongly desire trade goods and they have raided foreign settlements and sometimes relocated villages to gain easier access to trade goods (Hames, 1983), especially near mission stations (Chagnon, 2012:248–49). Just as importantly, they move close to missions for medical care and, to some extent, to gain protection from enemies because missionaries want to prevent war to enhance their proselytizing efforts. More importantly, Yanomamö raids are not well designed to acquire trade goods. The goal of a raid is to dispatch at least one enemy without losing a comrade. Raiders quickly retreat after a killing without entering a village to steal trade goods. In the past, in some areas, the Yanomamö raided neighboring Ye'kwana villages for trade goods (Hames, 1978) as well as abducting their women. Thus, to a very limited extent was raiding motivated to gain access to trade goods.

4. Conclusion

Chagnon's contributions to the study of warfare are of immense importance. Venezuelan government and missionaries have little control over Yanomamö political affairs. Studies of the Yanomamö provide critical, irreplaceable insights into the politics and warfare characteristic of much of human existence. The Yanomamö are not the only society that still actively represents this way of life; however, except for portions of Highland New Guinea most of the other accounts we have are only known historically and were not studied as intensively as the Yanomamö. Two important conclusions emerge from Chagnon's research. The first is that warfare sometimes is over reproductive and not productive resources. Analyses of cross-cultural evidence indicates that resource problems are associated with warfare (Ember & Ember,

1992). Few comparative studies have looked for the association between warfare and competition for women. But those who have done so show an association (Manson & Wrangham, 1991; Sellen & Hruschka, 2004). And even when productive resources are sought, they may be used for reproductive ends (Glowacki & Wrangham, 2015).

The second issue highlighted in Chagnon's research is the problem of revenge. Humans seem to differ fundamentally from the common chimpanzee, our closest phylogenetic relative who engages in lethal coalitionary violence. Revenge does not seem to be in the motivational repertoire of chimpanzees (Wrangham & Glowacki, 2012:24) for intergroup coalitionary violence. However, for the Yanomamö and many other groups (Beckerman & Valentine, 2008; Walker & Bailey, 2013) revenge for an affront whether it be an insult, shamanic killing, raiding death, or abduction of a woman is the most common cause of warfare or its perpetuation. The psychology of revenge and how it works to coordinate coalitionary actions as well as its fitness consequences are topics that have yet to be fully resolved, but Chagnon's rich description of the Yanomamö provides key insights.

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