

# The evolution of lethal intergroup violence

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**Recent findings and analyses in evolutionary biology, archaeology, and ethnology provide a favorable conjuncture for examining the evolution of lethal intergroup violence among hominids during the 2.9-million-year Paleolithic time span. Here, I seek to identify and investigate the main turning points in this evolutionary trajectory and to delineate the periodization that follows from this inquiry.**

collective violence | armed conflict | war | hominid evolution

Detailed and well documented reports of intergroup attacks and killings among free-ranging chimpanzee groups were initially published during the period from 1979 to 1986 (1–4). In subsequent years, data from additional research sites confirmed that such episodes of lethal violence were characteristic of chimpanzees as a species (5). These findings clearly raise an important question with respect to the evolution of lethal intergroup violence: Did the same constellation of causal factors that gave rise to the chimpanzee pattern of coalitionary killing of neighbors produce a parallel (and convergent) outcome among Paleolithic hominids? Recent findings and analyses in evolutionary biology, archaeology, and ethnology create a favorable conjuncture for advancing our understanding of the evolution of lethal intergroup violence. These data provide grounds for evaluating Wrangham's preliminary conclusion that "current evidence supports the hypothesis that selection has favored a hunt and kill propensity in chimpanzees and humans, and that coalitional killing has a long history in the evolution of both species" (ref. 6, p. 1).

The crux of Wrangham's explanation of the evolution of coalitionary killing is that fitness is closely correlated with access to food resources and that territorial enlargement thus enhances fitness. In short, "fitness is correlated with territory size" (other factors being equal) (ref. 6, p. 15). Unprovoked attacks on members of a neighboring community thus convey a selective advantage, provided that the costs to the attackers are low. The mechanism by which aggression is rewarded is intercommunity dominance. "If raiding leads to the wounding or death of a neighboring male, the neighboring community's competitive ability is substantially reduced" (ref. 6, p.15). The dominant community can thus freely encroach on the territory of its neighbor whenever food resources within its own territory are in short supply. The dominant community also may have an advantage in recruiting reproductive females. However, the capacity to translate additional females into increased fitness would be contingent on the commensurate expansion of food resources.<sup>†</sup> Thus, although intercommunity dominance "tends to lead to increased fitness of the killers through improved access to resources such as food, females, or safety" (ref. 6, p. 12), territorial gain is the critical ingredient for the realization of this fitness enhancement.

Wrangham applies his explanatory framework to an extensive array of available data on intraspecific coalitionary killing of adults among chimpanzees, bonobos, and wolves and is able to account for variability in the frequency of intercommunity attacks. For example, encounters between neighboring chimpanzee communities are most likely to eventuate in attacks when a single individual is spotted by a party of three or more males who are able to overwhelm a lone victim while incurring little risk

of injury to themselves. Attacks are more frequent in those portions of the chimpanzee geographical range where competition for food resources is intensified by longer dry seasons. Lethal intercommunity attacks are not reported for bonobos, who rarely engage in the kind of dispersed feeding that exposes lone individuals to fatal attacks by neighbors (ref. 6, pp. 12–18). All in all, the available data largely support the imbalance-of-power hypothesis and the intercommunity dominance-drive hypothesis formulated by Wrangham.

However, there is one apparent contradiction in Wrangham's explanatory framework. He documents border avoidance and underutilization of food resources located in the border areas between group territories. At the Tai study site, for example, ". . . 75% of time was spent in the central 35% of the [territorial] range" (ref. 6, p. 11). Although this substantial day-to-day frequency of border avoidance shows that coalitionary attacks by neighbors are anticipated (and constitute a pattern), such border avoidance also entails a reduction in the effective size of group territories as repositories of food resources, because 65% of these resources cannot be exploited in complete safety.

Available data are insufficient to precisely quantify the magnitude of resource underutilization at all chimpanzee study sites. However, the Tai data (cited above) clearly indicate that a substantial percentage of the available food resources present within a group territory are not exploited in this instance, and border avoidance is established by Wrangham as a general phenomenon.

If fitness is enhanced by territorial enlargement, then fitness would be reduced by a pattern of lethal intercommunity attacks that curtails resource availability along borders. Wrangham assesses the costs of aggression in terms of the risk of serious injury to the members of a party of chimpanzees carrying out an attack. Resource underutilization does not enter into his cost-benefit calculations or his fitness assessments. If the posited ". . . benefits to be gained by raiding or killing neighbors" (ref. 6, p. 15) flow from territorial expansion that, in actuality, only adds a buffer zone, rather than food resources, then the value of this benefit would need to be recalculated. Factoring in a resource-reduction penalty for initiating aggression, and rendering one's own border zone unsafe as a result, also alters the cost side of the equation. The circumstances under which the potential benefits of coalitionary attacks definitively outweigh the costs thus appear more narrowly circumscribed than Wrangham posits. Alternative adaptive strategies also may be superior in a broader array of contexts. Mutual nonaggression would clearly convey both mutual benefits and reduced costs. More specifically, the reported bonobo pattern of peaceful interactions between individuals of neighboring communities, in which ". . . they rest,

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<sup>†</sup>This point can be further elaborated. It is possible that adding females without increasing territory could augment fitness, but this fitness enhancement would transpire only if food resources were more than adequate. However, adding territory would not augment fitness under such conditions. In other words, Wrangham's argument presupposes that chimpanzees are a food-limited (rather than disease-limited) population, because intercommunity dominance would otherwise convey no selective advantage. See ref. 15 for a further discussion of the interrelationship between the food-limited status of a population and the adaptive significance of territorial gain.

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shared and consumed at feasts. The general atmosphere of these gatherings has been described as one of amiable rivalry in which an effort is made to put aside residual ill feeling arising from past quarrels. Gifts were exchanged, including bows, arrows, arrowheads, adzes, baskets, pigments, and shells for personal adornment. Each individual donor endeavored to outdo his or her counterpart in generosity. In the course of the festivities, men performed dances to the accompaniment of female singing (7). These gatherings provided a context for courtship leading to intermarriage. Kin ties between neighboring bands arising from marriage were reinforced by reciprocal visiting and a cultural practice of adoption whereby a child of one band was raised by a friend or relative of the parents residing in another band.<sup>¶</sup> This repertoire of peace-promoting practices facilitated more complete utilization of food resources in North Andaman, resulting in a higher population density (of 2.75 persons per square mile).

If fitness is augmented by territorial enlargement (as a general rule of selective advantage), then peace-promoting practices are adaptive and the maintenance of hostile intergroup relations is maladaptive under conditions commensurate with those found in the Andaman Islands. When relations with neighbors are friendly, an average-sized territory of 16.4 square miles is capable of supporting a band of 45 individuals. Hostile relations shrink the utilizable area to the equivalent of 12 square miles, with a peripheral zone about one-third of a mile wide subject to border avoidance. This reduced territory is sufficient to support a band of only 33 individuals.

When group territories are extensive and population densities are low, the percentage of territorial area rendered unexploitable by border avoidance is correspondingly reduced and the cost of hostile relations with neighbors would be less than that documented for the Andamanese. For example, a hunting and gathering band may require a territory of 100 square miles in a less favorable arctic or desert environment. Under these circumstances, avoidance of a one-third-mile-wide border zone would reduce a group's effective territory by 11.4%. With a 200-square-mile territory, the comparable figure is 8.1%. However, low population density also entails little or no competition for food resources and infrequent encounters between members of neighboring groups so that conflicts rarely occur and those that do are peacefully resolved (ref. 7, pp. 133 and 142).

The selective factors that give rise to coalitionary killing of neighboring group members among chimpanzees do not have the same effects in the case of unsegmented foraging societies. Fitness does correlate with territory size, or more accurately, effective territory size (provided that all proximate territories are occupied). Moreover, intergroup competition is intensified at higher population densities. But the attainment of intercommunity dominance is thwarted by a combination of factors that increase the costs to attackers. First, a party of hunters from one group cannot be certain that they are able to make an accurate assessment of the strength of the opposition. There is no certainty that a single individual who has been sighted is indeed alone, because hunters often work in pairs or teams that stalk game silently and employ ambush techniques. It is consequently unclear whether a favorable imbalance of power obtains. There is substantial risk that costs may be underestimated. Second, territory owners have intrinsic advantages over intruders that are akin to the advantages enjoyed by combatants who have set up an ambush in territory well known to them but not to opponents. Hunters lying in wait along game trails can readily kill intruders. Third, a hunter is a dangerous quarry because he possesses

weapons that kill at a distance. Weapons augment the lethality of combat and amplify the costs of assessment errors made by attackers. These errors include the potentially mistaken deductions that the party seeking to initiate an attack has remained undetected (and enjoys the advantage of surprise) and that attackers have a numerical advantage (a deduction based on the assumption that all members of a targeted hunting party have been spotted).

If entirely accurate assessments could be made, weapons would amplify the effects of both numerical superiority and surprise, and the consequences of augmented lethality would accrue to attackers. In other words, the decisive factor in the balance of power between intruders and territory owners is detection, not weaponry. (That asymmetrical detection outweighs superiority in weapons and numbers and definitively determines the outcome of territorial incursions is precisely the point Jacko and Topsy sought to make.) Moreover, the risks of both asymmetrical detection and assessment errors are intrinsically greater for intruders as they endeavor to move into unfamiliar territory in which hunters employing ambush techniques may well be operating from concealed positions. The necessity of movement in initiating an attack is itself a disadvantage with respect to detection. Moreover, territory owners invariably sound the alarm if combat is joined. Other hunters in the vicinity converge on the area and may potentially cut off the retreat of intruders. In sum, projectile weapons amplify the casualties (and costs) of initiating attacks on neighbors as a result of the intrinsic advantages enjoyed by defenders.

Although the differences are striking, there also are a number of notable similarities between chimpanzees and bonobos (on the one hand) and the members of unsegmented foraging societies (on the other) in the realm of relations between groups. The potential for lethal intergroup violence is an ambient condition of existence in both cases, and we can conclude that this potentiality has been an integral contextual feature of human (hominid) evolution from the beginning of the Paleolithic period to the ethnographic present. Three responses to this condition are noted in both cases: (i) avoidance, (ii) positive engagement in friendly relations with neighboring local groups, and (iii) aggression that may result in territorial gain or loss. Friendly relations facilitate full exploitation of the zone along territorial borders, whereas hostile relations lead to border avoidance and underutilization of the food resources present in this zone. Hostile relations are conditioned by resource competition and also vary in intensity in accordance with the degree of resource competition (other things being equal). The subjects involved in acts of aggression against neighbors are nearly always adult males who are the group members that most frequently exploit food resources located in the zone along territorial borders. Attacks are invariably opportunistic, in that the assessment of a significant advantage (in numbers or in asymmetrical detection or both) is always a precondition for initiating violence that is lethal in intent. Nearly all attacks occur in close proximity to territorial borders. Attacks on base camps where group members sleep are nonexistent among chimpanzees and rare to nonexistent on the part of unsegmented foraging societies.<sup>||</sup>

<sup>||</sup>This generalization is based on detailed analysis (7) of the eight unsegmented foraging societies in Ross's (16) sample of 93 societies [which is a half sample of Murdock's and White's (17) Standard Cross-Cultural Sample]. Attacks on settlements *per se* are not reported for the Mbuti, Semang, Copper Eskimo, !Kung, Yahgan, and Slave. The Slave were subject to such attacks by the segmental Cree but did not carry them out. The Ingalik were likewise subject to raids on their settlements by their segmental neighbors (the Koyukon and Kolchan) in the 1840s, and they responded in kind. However the Ingalik did not carry out raids against the settlements of fellow tribesmen or those of their unsegmented neighbors, the Kuskowagamiut. Among the !Kung and Yahgan, the family of a homicide victim may go to the settlement of the perpetrator and attempt a capital punishment execution, but only the perpetrator is targeted, so this endeavor does not constitute an attack on a settlement *per se*. Attacks on settlements are reported for the Andamanese,

<sup>¶</sup>In unsegmented societies, it is not uncommon for living parents to give a child to kin or friends of another local group to be adopted and raised by them. Among the Andamanese, nearly all children older than 7 years of age are raised by adoptive parents (7). This cultural practice is obviously conducive to mutual nonaggression between local groups linked by such child transfers.

Elaboration of the means of maintaining friendly relations and the capacity for sharing access to resources with neighbors set humans apart from chimpanzees and bonobos. Indeed, it might be said that the members of unsegmented foraging societies increase their fitness through “improved access to resources such as food, females, or safety” (ref. 6, p. 12) by eschewing efforts to achieve intercommunity dominance in favor of egalitarian relations of friendship, mutuality, and sharing. This course of action is a wise adaptive choice because dominance is characteristically unattainable, and the only effective means of increasing territory size is to fully utilize border zones. The capacity to maintain friendly relations that allow for access to a neighbor’s territory during lean years is particularly important in environments where there are localized year-to-year fluctuations in resource availability. These cooperative relations clearly played a key role in the Upper Paleolithic expansion of human populations across the globe into every environmental zone in which terrestrial mammals of any kind are capable of existing (9). Intergroup cooperation facilitates the rapid colonization of open environments. Under these circumstances, territory size is not a relevant variable and fitness does not correlate with it. Fitness instead correlates with the social group’s reproductive rate, which is primarily a function of the ease of obtaining reproductive females from neighboring groups (based on a past history of positive relations).

We may now turn to the archaeological record to ascertain the earliest known use of projectile weapons that kill at a distance. At present, that date has reliably been established as about 400,000 years ago. Wooden spears 1.82–2.60 m in length that “resemble modern javelins” have been recovered from a site near the Schöningen brown coal mine in Germany.

Found in association with stone tools and butchered remains of more than 15 horses, the seven spears... strongly suggest that systematic hunting, involving foresight, planning, and appropriate technology, was part of the behavioral repertoire of premodern hominids. The use of sophisticated spears at these remote times necessitates rewriting of many current theories on early human behavior and culture.

Ref. 10, p. 8

There is considerable continuity in the stone tools manufactured by *Homo erectus* during the period from 1,000,000 to 300,000 years ago. Temporal homogeneity in the stone component of the tool kit provides grounds for suggesting that this same continuity applied to wooden implements as well. Wooden spears like those described above may then have been used 1 million years ago. Large game made up a significant component of the diet during this period, and it is reasonable to assume that spears were used in game procurement and in driving off scavengers. Grahame Clark (11) provides a concise summary of the diet and probable tool kit of the *H. erectus* inhabitants of Zhoukoudian Cave in northern China, a site dated at 500,000–350,000 B.P.

To judge from the animal remains associated with him, Peking man depended largely on venison, since two-thirds of them belong to two species of deer, namely *Euryceros pachyosteus* and *Pseudaxis grayi*. His victims also included elephants, two kinds of rhinoceros, bison,

water buffaloes, horses, camels, wild boars, roebucks, antelopes, and sheep, not to mention such carnivores as saber-toothed tigers, leopards, cave bears, and a huge hyena. How he managed to secure this varied selection of game we can only speculate. No specialized projectile-heads have survived in the archaeological record, but to judge from evidence from elsewhere, he would have had available wooden spears with the tip hardened in fire, and it seems likely in view of the character of some of his victims that he would have used primitive pit traps.

Ref. 11, p. 27

The selective factors that favored coalitionary killing of neighbors may have remained in play until as late as 1 million years ago. The precise chronology of the persistence of these selective factors during the Lower Paleolithic remains an open question at present. However, the development of the throwing spear, used in conjunction with ambush hunting techniques, ushered in an era in which the enhanced lethality of weaponry amplified the costs of assessment errors, and the necessity of movement also placed intruders at a comparative disadvantage with respect to both detection and assessment. Moreover, asymmetrical detection rather than a numerical imbalance of power determined the outcome of hostile encounters. This reconfiguration of the decisive factors in lethal conflict not only raised the stakes (or potential costs) for would-be aggressors but also rendered the benefit of intercommunity dominance unattainable. Because superior numbers were not invariably decisive in encounters between hunting parties, an initial success would neither materially reduce the stakes for aggressors in subsequent attacks nor make it possible to freely encroach on the territory of a neighboring group that had sustained a casualty. Under these circumstances, aggression resulted in stalemate and a condition analogous to a war of attrition rather than territorial gain.

These developments marked a major turning point in the evolution of lethal intergroup violence and in the character of interrelations between neighboring groups. Although fitness continued to be related to territory size (for food-limited populations in occupied environments), selective circumstances no longer favored aggression as a means of achieving territorial gain. Conflict avoidance and the development of intergroup relations of friendship, mutuality, sharing, and cooperation were favored instead. Intragroup cooperation was elaborated in conjunction with the teamwork entailed by large game hunting and was further reinforced by mechanisms for sharing large animals jointly killed by a hunting party. Development of these practices provided a template for establishing positive relations between neighboring social groups that could readily be realized when two bands temporarily camped and hunted together. Conflict avoidance dictated that groups move apart to alleviate resource competition whenever possible. This response to crowding facilitated migration out of Africa into the temperate and subtropical zones of Europe and Asia, vastly expanding the geographic distribution of *H. erectus*. In other words, the development of the throwing spear altered the means of production as well as the social relations of production, distribution, and consumption within groups in fundamental ways that also transformed intergroup relations and influenced subsequent hominid evolution.

This period of Paleolithic warlessness, grounded in low population density, an appreciation of the benefits of positive relations with neighbors, and a healthy respect for their defensive capabilities, lasted until the cultural development of segmental forms of organization engendered the origin of war (7). This organizational transformation facilitated the mobilization of all adult male group members and their participation in preplanned dawn raids on settlements in which the tactical advantages of surprise and numerical superiority could be brought to bear. At

who represent a transitional case with respect to the origin of war. However, no such attacks are recorded in colonial records that cover the period from 1863 to 1899. These records contain detailed accounts of numerous border conflicts during this early contact period. In all, these data indicate that, for unsegmented societies, attacks on settlements may be characterized as rare to nonexistent. Events that occur less than once a generation are considered rare in the comparative cross-cultural study of lethal violence. Such events are generally not within the life experience of the members of these societies.

this juncture, the unit involved in combat is a raiding party (a military organization) rather than a hunting party (an economic organization), and the location of combat shifts from the border zone to the sleeping quarters at the core of a group's territory. At the same time, the intrinsic military advantage shifts from defenders to attackers. All of the attackers are combatants, whereas less than half of those under attack are armed. Attackers characteristically inflict numerous casualties while suffering few or none. This outcome is a consequence of weaponry amplifying the advantages of surprise and numerical superiority.

The earliest conclusive archaeological evidence for attacks on settlements is a Nubian cemetery (site 117) near the present-day town of Jebel Sahaba in the Sudan dated at 12,000–14,000 B.P. (7, 12). War originated independently in other parts of the world at dates as late as 4,000 B.P. (13). Otterbein argues that agriculture was only able to develop initially at locations where ambushes, battles, and raids were absent (14).

The evolution of lethal intergroup violence thus encompasses three major periods: (i) the era of coalitionary killing, (ii) the era of intrinsic defensive advantage, and (iii) the era of war. An

advance in weapons technology (the javelin-like throwing spear) engenders the first transition, whereas an advance in military organization and tactics produces the second. The decisive significance of these factors is expectable in light of what we know from recorded military history. However, the duration of the first two eras extends over hundreds of thousands of years. The protracted character of these eras is consistent with the slow pace of technological and organizational change during the Paleolithic period.

The main objective of this paper is to specify the major turning points in the evolution of lethal intergroup violence, to delineate the periodization that results from this specification, and to broadly characterize each era. The dating of these periods can be expected to be refined as additional archaeological data come to light. Moreover, the key transitions did not occur simultaneously in every world area so that regional, rather than global, chronologies are required, especially with respect to the origin of war.

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