The Evolution of Peace

Luke Glowacki
Boston University
laglow@bu.edu

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Abstract

While some species have affiliative and even cooperative interactions between individuals of different social groups, humans are alone in having durable, positive-sum, interdependent relationships across unrelated social groups. Our capacity to have harmonious relationships that cross group boundaries is an important aspect of our species' success, allowing for the exchange of ideas, materials, and ultimately enabling cumulative cultural evolution. Knowledge about the conditions required for peaceful intergroup relationships is critical for understanding the success of our species and building a more peaceful world. How do humans create harmonious relationships across group boundaries and when did this capacity emerge in the human lineage? Answering these questions involves considering the costs and benefits of intergroup cooperation and aggression, for oneself, one's group, and one's neighbor. Taking a game theoretical perspective provides new insights into the difficulties of removing the threat of war and reveals an ironic logic to peace—the factors that enable peace also facilitate the increased scale and destructiveness of conflict. In what follows, I explore the conditions required for peace, why they are so difficult to achieve, and when we expect peace to have emerged in the human lineage. I argue that intergroup cooperation was an important component of human relationships and a selective force in our species history in the past 300 thousand years. But the preconditions for peace only emerged in the past 100 thousand years and likely coexisted with intermittent intergroup violence which would have also been an important and selective force in our species' history.

"There is no Enga word for peace…" (Wiessner, 2019, p. 231)

The "Tauade not only have no word for peace but display no awareness of a social order that is ruptured by violence" (Hallpike, 1974, p. 74)

1. INTRODUCTION

The debate about the origins of war and peace in the human lineage is at an impasse over whether our evolutionary history is best characterized by lethal intergroup aggression (war) or peace. One perspective argues that a state of lethal hostility between early human groups characterizes most our evolutionary history (Gat, 2009; Keeley, 1996; van der Dennen, 2002; Wrangham & Glowacki, 2012), while the other argues that peace extends deep into our lineage with war only recently co-evolving with increasing social complexity and agriculture (Fry, 2011; Kelly, 2013; Kelly, 2005). I propose a different approach, instead asking what are the preconditions necessary for humans to have sustained positive-sum intergroup relationships and when were they likely to have emerged? Answering these questions involve considering the costs and benefits of intergroup cooperation and aggression, for yourself, your group, and your neighbor. Taking a game theoretical perspective provides new insights into the difficulties of removing the threat of war, but also reveals an ironic logic to peace—the factors that enable peace also facilitate the increased scale and destructiveness of conflict.

Humans are unusual for the range of our intergroup relationships which can include affiliation and altruism towards strangers as well as destructive large-scale wars. While other social species such as dolphins and bonobos may have affiliative relationships between groups (Danaher-Garcia et al., 2022; Elliser et al., 2022), sustained positive-sum relationships that cross pronounced group boundaries are exceedingly rare among non-human mammals likely appearing only in a few eusocial insect species. Our cousins the bonobos often have affiliative interactions with other bonobo groups that include grooming, sex, and sometimes food sharing (Lucchesi et al., 2020; Samuni et al., 2022). Less well known is that

violence is common when two bonobo groups meet. Of 92 intergroup encounters in the Kokolopori Bonobo Reserve, 34% of them included physical aggression with 15% resulting in injuries to at least one bonobo (Cheng et al., 2022). At the LuiKotale site, intergroup encounters between bonobo groups "were more aggressive than tolerant" with 47% of the intergroup encounters having "large-scale coalitionary aggressive events" often resulting in injuries (Moscovice et al., 2022). Among non-human social animals that engage in lethal intergroup conflict, including banded mongoose, wolves, chimpanzees, and meerkats, there is little evidence that any of these species exhibit behaviors approaching the positive-sum, tolerant intergroup interactions that humans frequently have.

The scale and scope of our conflicts are shaped by the social groups they involve, but humans are also members of multiple social groups simultaneously with overlapping non-exclusive boundaries (e.g. family, larger kin group, neighborhood, university community, city, religious organization, political party, and nation). Conflict can occur either within any of these groups, such as when factions of an extended family feud, or between groups, such as when one religious sect persecutes another. For these reasons, I avoid the distinction sometimes made between internal and external warfare because it does not capture the difficulty of achieving peace or the intensity of warfare. Instead, I focus on violence and peacemaking between social groups—whether those are bands, residential communities, clans, or tribes.

Our capacity to interact with members of other social groups peacefully is an important factor in our species' success (Fuentes, 2004), facilitating the spread of ideas, materials, and goods across group boundaries, contributing to cumulative cultural evolution (Sterelny, 2021). Intergroup exchange allows us to build the cultural technologies to adapt to a seemingly endless variety of ecological and social environments. Periods of peace may also fuel increased social complexity due to expansion of exchange between groups that would otherwise be in conflict (Wiessner, 1998, 2019). The challenge of building peaceful intergroup relationships is formidable because peace requires coordinating the interests of every

individual to favor non-aggression, while intergroup aggression can be unilaterally initiated but subsequently involve the entire group.

I argue that peace is the product of cultural technologies that depend on factors that are likely to have only recently emerged in our species' history, including social institutions and cultural mechanisms for preventing and resolving conflicts. I focus on decentralized or small-scale subsistence societies, such as hunter-gatherers and horticulturalists, because they are the most relevant to understanding the origin of peace in human evolution. This is because for much of our history we lived in small unstructured groups lacking centralization and significant social institutions. While there is strong evidence that humans evolved to be tolerant of out-group members and form cooperative relationships with non-kin, my argument will show we did not evolve an innate capacity for peace. Rather, our capacity for flexible relationships, cultural incentive systems, and strategic modification of behavior allowed us to develop the cultural technology for durable peace (cf. Kim and Kissel 2018, who call it "peacefare"). Ironically the cultural tools that allow us to develop peaceful relationships are the very same ones that allow us to sometimes engage in total war. Thus, as Mead (1940) famously said of warfare, peace, too, is an invention.

My argument is structured as follows. In the remainder of this section, I review previous approaches to the study of peaceful societies, and put forward an operational definition of peace that will guide the remainder of the paper. In section 2, I argue that peace is best understood as a solution to a cooperative dilemma such as the Prisoner's Dilemma, while in section 3 I explore the conditions that are required for peace. Section 4 describes the tensions between war and peace and section 5 reviews the relationship between States and peace in small-scale societies. In section 6, I review evidence for the origins of peace in human evolution, and section 7 describes the coevolution of peace and intergroup conflict. Section 8 attempts to explain why other mammals lack peace and section 9 explores variation in war and peace

across human societies. I conclude in section 10 with arguing that our human ancestors were neither warlike or peacelike but instead were like humans everywhere—they struggled to create peace, but could and did use aggression strategically.

1.1. Warlessness, Peace, and Cooperation

Previous research on peace has often categorized groups as either "warlike", "warless", or "peaceful" and argued that "peaceful societies should lack whatever instigates war" (Kelly, 2000, p. 11). One limitation with this approach is that the absence of war does not necessarily constitute peace and the lack of war tells us little about the nature of interactions between groups and the factors underlying those relationships (van der Dennen, 2014). The two main explanations for warlessness among small-scale non-state societies in the ethnographic record are isolation and subordination, neither of which is synonymous with peace.

First, groups without war may be geographically isolated. Geographic isolation, often combined with small population size was the most important predictor of low rates of intergroup violence in precontact Polynesian societies where the most "peaceful societies were located more than 100 kilometers from their nearest neighbor" and had under 1000 individuals (Younger, 2008, p. 927). The Copper Inuit are often used as an example of a peaceful society but also had "500 miles of barren coastline [that] separated the Copper [Inuit] from their nearest neighbors…." (Jenness, 1921, p. 549). Inuit groups that did live near other groups often had lethal intergroup violence with high casualty rates (Burch, 2005).

Second, warlessness often results from the threat of violence from stronger groups, resulting in avoidance or subservient cultural roles. The Semai in Malaysia are regularly used as an exemplar of peaceful hunter-gatherers because they have low or non-existent levels of violence towards non-Semai: "Their worldview, and humanity's place in it, does not include any violence" (*Semai | Peaceful Societies*, 2022). However, their peacefulness appears to be strongly influenced by the military superiority of the surrounding agricultural

groups. The Semai "openly and often express fear that outsiders will attack them. They… teach their children to fear and shun strangers, especially non-Semai" (Dentan, 1978, p. 97). One Semai man remarked that "If we had weapons, we'd drive the Malays off our land (aims an imaginary rifle, squinting and grinning)" (Dentan, 2004, p. 169). The "Semai have learned that… counterviolence is useless; one just gets hurt again, they say. That does not mean that people… never fantasize about fighting against Malay. In fact, in the past when conditions were favorable, they have actually mounted violent resistance… Most of the time, though, they just do not think physical violence will work. Why get hurt for nothing?" (Dentan, 2004, p. 173).

So common is the pattern of stronger groups completely dominating weaker groups that Helbling (2006) argues most cases small-scale societies lacking war are best categorized as "enclaves", in which militarily subordinate groups retreat to inaccessible forest and mountain areas. Service (1971, p. 35) remarks that "Nowadays [hunting-gathering bands] are enclaved among more powerful neighbors… and they cannot but lose or be heavily punished for any breach of the peace. *They are better called "The Helpless People" or "The Defeated People'."* Many of the groups that are typically used as exemplars of peaceful societies such as the Semai, Hadza, Mbuti, !Kung, Ju/'hoansi, G/wi, Paliyans, Batek, and Amish are enclaved and surrounded by more powerful neighbors.

Rather than classifying societies as "peaceful" or "warlike", a more fruitful approach is to examine relationships between groups, focusing on the factors that shape harmonious positive sum relationships (Baszarkiewicz & Fry, 2008; Kissel & Kim, 2019). The definition of peace I use is modeled on Anderson (2004) and Helbling's (2006) positive and negative conceptions of peace and tries to capture a general state of interactions between groups. *Peace is a condition where ongoing interactions between different social groups are marked by the absence of or infrequent occurrences of aggression and violence, alongside the expectation and presence of generally harmonious relationships not enforced with the threat of violence.* Accordingly, peace is

156 an ongoing *state* of interactions between members of different groups (whether kin group, clan, band,
157 tribe, etc.), characterized by harmonious interactions where conflicts are generally resolved and are
158 expected to be resolved without violence. A society may have peace with one group while having violent
159 interactions with another group. This definition does not require the complete absence of aggression or
160 violence in intergroup interactions, only that violence is rare, unexpected, and quickly resolved.
161
162 **1.1.1 Cooperative Relationships Do Not Imply an Absence of War**
163 Intergroup cooperation is likely universal across human societies, including among societies with high
164 rates of war and violence. While cooperation, including trade, may promote peace, the presence of
165 cooperation alone is not evidence that war between groups is absent. This is an especially important point
166 when examining the archaeological evidence of intergroup relationships. Cooperation, including trade
167 and marriage, can occur in the context of broader intergroup hostilities or large power asymmetries, such
168 as those in patron-client relationships where the weaker parties act in a context of intimidation (as the
169 Semai appear to be). In cases of active hostilities between two populations, individual parties often
170 continue to cooperate across group boundaries, exchanging information, materials, or goods. Thus,
171 archaeological and ethnographic evidence of cooperation alone is not satisfactory for demonstrating the
172 absence of war, even though intergroup cooperation can enable peace, and peace expands the potential for
173 cooperation (Keohane, 2005).
174
175 **2. PEACE AS A SOLUTION TO A COOPERATIVE DILEMMA**
176 **2.1. The Structure of Decentralized War**
177 Understanding how peace is achieved in small-scale decentralized societies requires first understanding
178 how and why individuals participate in war in these same types of groups. Small-scale decentralized
179 societies have a fundamentally different pattern of conflict than state societies with militaries (Wright,
180 1942). Counter-intuitively, the individual costs of participation in war appear to be relatively low and the

potential marginal benefits significant. Small-scale warfare is acephalous and decentralized, occurring in the absence of formal leadership or chains of command, mechanisms to compel participation, and mechanisms to restrain conflict. Membership is typically ad hoc, composed of available people who want to participate, and leadership is informal, situational, and non-coercive. Unlike militaries which can involve years of compelled participation, small-scale warfare lasts for the duration of the event—hours to days—after which the participant returns to their ordinary life. Raiding parties often form without consent or even the knowledge of the larger social group, coordinated by one or two people who convince others to join them[1]. Unlike warfare in state societies, war in small-scale societies does "not seem to be carried out with any global strategy in mind" (Tornay, 1979, p. 114).

The most common pattern of war is the raid, primarily composed of young men. Raids are usually undertaken to fulfill the proximate goals of the raiders themselves which may include revenge, capturing loot, or gaining status. Raiding parties use strategic timing and ambush to attack one or two victims at very low risk to themselves, usually while the victims collect water, do daily activities, or exit their village in the morning (Gat, 1999). The victims may be members of another ethnolinguistic community or members of the same ethnolinguistic community, but of a different lineage or clan (as in feuding). Because the primary tactic in small-scale war is surprise, raiders can choose to attack when the odds heavily favor their success. As a result, attackers on raiding parties face an extremely low risk of being killed or injured during an attack (Beckerman et al., 2009; Chagnon, 1988; Glowacki et al., 2016; Mathew & Boyd, 2011; Wrangham & Glowacki, 2012). A similar pattern is found in chimpanzees, who also form raiding parties that attack members of other groups when they have a significant imbalance of

[1] During my fieldwork, I learned of several nascent raiding parties that did not gain a sufficient number of participants to mobilize and were then abandoned. Raiders typically took great care to keep non-raiders from learning of their plans, lest they be told not to go, chastised, or sanctioned for initiating a raid. At the same time, they often tried to limit the number of people who joined to maximize their stealth and increase the individual shares of any potential spoils.

power (approximately 7 attackers to 1 victim) with little evidence of chimpanzee attackers being seriously injured or killed (Wilson et al., 2014; Wilson & Wrangham, 2003). When there are causalities among human attackers, it is usually because they are detected and ambushed while traveling to the site of their intended raid but such accounts are rare (Wrangham & Glowacki, 2012). Despite the low risk to attackers, members of raiding parties still must overcome fear and confrontational tension (Collins, 2009; Mathew & Boyd, 2011; Roscoe, 2007). "This fear is curious because there is no memory of any Wao raider being killed, or even seriously injured, by the Waorani he attacked" (Beckerman et al., 2009, p. SI: 1). While the risks to attackers on raids are low, the overall mortality rates from intergroup violence can be high, though the severity is primarily driven by victims of raiding parties rather injuries to attackers.

Thus far we have described the most common pattern of small-scale warfare that has close parallels in intergroup conflict in chimpanzees. As societies increase in sociopolitical complexity, they often adopt more structured forms of intergroup violence, such as coordinated attacks and battles (Dye, 2009; Dye, 2013; Glowacki et al., 2020), which can result in a greatly increased mortality rate of attackers and increase the chances of the defenders being successful (Dreu & Gross, 2019). Structured organized conflict such as high risk battles presents a different set of strategic dynamics that may better approximate the conditions under which states wage war than the pattern commonly found in decentralized societies (Buckner & Glowacki, 2019).

2.2. The Individual Benefits to Attackers

Attackers in small-scale warfare often benefit personally from their participation through private incentives. Status is almost universally accorded to warriors, providing an important arena for men in the same society to compete with each other for status (Gat, 2009; Glowacki & Wrangham, 2013; Wright, 1942). Across societies, even among mobile hunter-gatherers, warriors frequently take material plunder, including captives or goods (though mobile foragers appear to do so to a much lesser extent than other

types of social organization) (Cameron, 2011; Gat, 1999, 2000). Captives can be used as reproductive partners, for labor as slaves, or to expand one's kin networks through adoption. In the few cases where the individual benefits of warfare have been quantified, they appear to improve the reproductive opportunities of warriors (Chagnon, 1988; Dunbar, 1991; Fleisher & Holloway, 2004; Glowacki & Wrangham, 2015; Hames, 2020; Macfarlan et al., 2014, 2018). The specific mechanisms are likely to vary between societies ranging from increased access to bridewealth, opportunities to make alliances with people who may provide reproductive partners, increased desirability as a potential partner, or other cultural mechanisms (though see Beckerman (2009) for a potential counter-example).

Even in instances where intergroup violence is not socially endorsed, attackers often still receive social benefits from their peers. The ethnography of small-scale societies is replete with examples in which intergroup violence is subject to general reprobation or even punished, but a smaller subset of society may laud warfare, providing the attackers with status among their peers. In the absence of material or social incentives, war can provide endogenous motivations through "offer[ing] excitement not found in the village" (Westermark, 1984, p. 116). "Old informants speak about the pleasurable excitement in preparing for and setting out on a… raid…. [which] might even have been welcomed as a break to long, tedious hours of work…" (Dozier, 1967, p. 78). Thus, even if society at large does not accord warriors with prestige, and war is unlikely to result in captured loot, warriors may still be endogenously motivated to participate in raids or be accorded esteem by their peers.

2.3 The Collective Costs and Benefits of War

"War is bad and nobody likes it. Sweet potatoes disappear, pigs disappear, fields deteriorate and many relatives and friends get killed" (Pospisil, 1963, p. 89)

Despite the common assumption that warfare in human groups is driven by competition for natural resources, there is mixed evidence of a relationship between competition for resources and the intensity, frequency, or scale of war in small-scale societies (Adano et al., 2012; Scheffran et al., 2012). Many ethnographers argue that there is no relationship, as warfare commonly occurs in regions with abundant resources including territory. In many cases, successful groups may not acquire the territory of the defeated groups. Moreover, any territory acquired through war would be a collective benefit available to both warriors and non-warriors, exacerbating the collective action problem of intergroup violence.

While individual warriors may benefit from participating in war, there are two major collective costs from warfare borne by all members of the attackers' group: the risk of being killed or injured in a revenge attack and decreased access to resources though reduced opportunities for intergroup contact and the creation of unused buffer zones. The desire for revenge is a major proximate cause of war in small-scale societies and often results in the deaths of more people than the initial offense (Boehm, 2012a; Walker & Bailey, 2013). After an attack, the most likely response from the attacked group is to launch an attack of their own against the offender's group, thus leading to tit-for-tat raiding. Because the specific identity of individual attackers is usually unknown, any member of the offender's groups will suffice as a target. As a result, *the original attackers are usually at no or little more at risk of being a victim of revenge than any other group member*. The risk of retaliation then falls on *all* group members, regardless of their participation in the initial intergroup conflict[2].

[2] During my dissertation fieldwork, when enemy raiders were detected (through footprints, observation at a distance, or after a raid) there was often extensive speculation about who the raiders may have been and where they were from. Although people could reasonably infer the larger group identity of attackers (such as Turkana or Suri), it was impossible to identify the specific attackers. Raiders would also take pains to conceal their identity by often using circuitous routes back to their camps.

In addition to the risk of being killed in revenge, wars impose collective costs by reducing opportunities for trade, the exchange of information, and access to potential reproductive partners both within and between groups. While cooperation frequently continues across group boundaries during intergroup conflict, it is often reduced or severely curtailed as people avoid interacting with members of groups that are hostile to them. War also has the often-devastating effect of producing large unused border or buffer areas that people avoid (Evans-Pritchard, 1957; Glowacki & Gonc, 2013; Turton, 1979). People may also flee areas at high risk of conflict areas even if those regions are resource abundant, losing access to valuable resources[3]. For subsistence populations, these large unused border zones can mean the devastating loss of access to productive game land, grazing areas, and water sources.

2.4. The Cooperative Dilemma of War and Peace

I have shown that participation in small-scale war is low risk to attackers because of the strategic use of ambush. At the same time, attackers are likely to receive important material and social benefits, especially status. The costs of war, however, are primarily borne by all members of the attacker's group, including the risk of retaliation, the creation of unused buffer zones, and the loss of opportunities that come from intergroup contact. As a result, a dynamic exists in which it may be individually beneficial to initiate intergroup violence because of private benefits, but simultaneously beneficial for other members of the group to have peace.

The insight that war may be hard to avoid even when peace is the most beneficial strategy for a group as a whole has been long recognized (Schelling, 1980). In fact, efforts to make one's own group more secure

[3] Shortly before crops of sorghum were ready for harvesting, the threat of a large raid by the Turkana became so great that a nearby settlement made the decision to abandon the area leaving their crops to spoil, while my group of settlements decided to remain. Our neighbors almost certainly met with severe hunger later in the year.

may ultimately increase the likelihood of conflict. This is because other groups are likely to respond in kind, particularly when they have incomplete information (known as the Security Dilemma) (Blattman, 2022; Levy, 1998). The dynamic between war and peace is commonly modeled as a prisoner's dilemma where any individual member may be better off defecting (initiating aggression against outgroups), but the entire group would be better off with peace (cooperating) (Cohen & Insko, 2008; Coombs & Avrunin, 1988; Rusch, 2013; Snyder, 1971; van der Dennen, 2014). Depending on the dynamics of the conflict, other cooperative dilemmas may better match the specific context, including games of Chicken or the Stag hunt, or Attacker-Defender games (Dreu et al., 2016; Dreu & Gross, 2019; Rusch, 2022; Schelling, 1980). Regardless of which cooperative dilemma is the best match for the specific group dynamics, the difficulty of limiting the payoffs of aggression by individuals is one of the most formidable barriers to the emergence of peace in small-scale societies.

Preventing conflict is difficult because a single act of aggression by one group member can be enough to trigger conflict (Figure 1), as other members of the attacked group seek revenge. Thus peace requires coordinating the interests of all group members for non-aggression making sustained peaceful relationships difficult to achieve, especially once a conflict has started. "A fundamental reason for the perpetuation of cycles of raiding… was that a unilateral decision to cease fighting was impractical… so long as neighboring villages continued to be willing to fight" (Ploeg, 1979, p. 143). It also means that even one individual acting unilaterally can determine the nature of intergroup relationships. As Clastres notes (2010, p. 193), "The power to decide on… war and peace… no longer belong[s] to society as such, but… to the … warriors, which would place its private interests before the collective interest of society… *The warrior would involve society in a cycle of wars it wanted nothing to do with.*"

The payoffs from aggression are not symmetric across a population because individuals vary in how much they are likely to benefit from their participation. Young men, in particular, are especially prone to status

seeking behaviors, including acts of aggression, exacerbating the conditions for war (Ganie, 2020; Yair & Miodownik, 2016). This is hypothesized to be due to the high levels of reproductive competition they generally face. While women in small-scale societies rarely participate in violence themselves, they often have an important role in encouraging men towards violence through teasing or ridiculing men who abstain from violence.

Thus, achieving peace requires solving an iterated cooperative problem like the prisoner's dilemma that each member of a group plays repeatedly in encounters with any member of another group. This dynamic is further exacerbated by the fact that war does not necessarily have to originate with unprovoked aggression but can instead arise from routine conflicts between individuals. Conflicts are an inevitable feature of social life no matter how pacific the cultural values. Any conflict has the potential to escalate, resulting in violence and triggering retaliation. Furthermore, peaceful exchanges or interactions may inadvertently result in the injury or death of a group member; an accidental death or injury may be interpreted as an act of aggression leading to retaliation and initiating a cycle of tit-for-tat war. Therefore, the conditions that give rise to peace must not only coordinate the interests of individuals towards cooperation but must also be tolerant and resilient against instances of real or perceived defection.

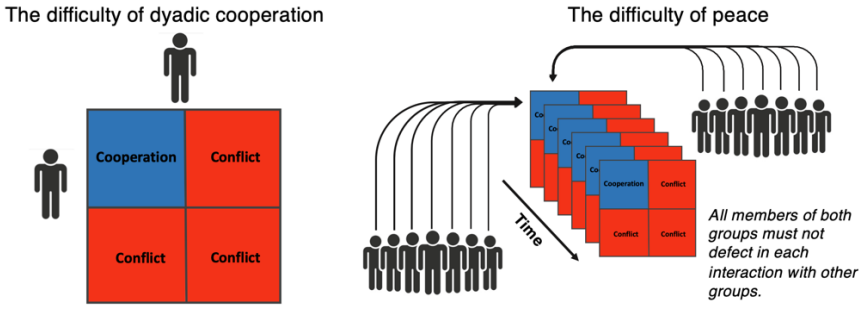

Figure 1. Peace as a Prisoner's Dilemma. *Intergroup conflict can be studied as an iterated Prisoner's Dilemma. The key challenge to peace is developing payoff systems that favor cooperation by member of both groups that are resilient against real or perceived defection.*

341

342 **2.5. Relevance to Centralized (State) Warfare**

343 My analysis focuses on intergroup violence in small-scale decentralized societies because these kinds of
344 society best resemble our understanding of ancestral human groups. This analysis is both relevant to and
345 diverges from warfare in centralized societies such as states. In centralized societies such as states, or
346 chiefdoms such as many Plains Indians, intergroup violence typically is directed through an organizational
347 structure including chiefs, officers, or militaries. This organizational structure solves the coordination
348 problems inherent in warfare by incentivizing and organizing combatants, preventing defection from
349 cowardice and desertion (often through extreme sanctions), and mitigating the risk of unprovoked
350 aggression by group members. The organizational structure can also incorporate a global view of the
351 group and use violence to achieve the goals of the group. Because of the centralization through which war
352 is waged by states to advance the strategic aims of the group, the appropriate level of analysis is the group
353 itself, not the individuals who compose the group (Schelling, 1980). Thus, Blattman (2022, p. 17) writes
354 about war in state societies, "Wars are long struggles…. Big groups are *deliberative and strategic*".

355

356 This quotation highlights the fundamental difference between small-scale decentralized war and
357 centralized war that underlies the game theoretical logic of war and peace: whether the most appropriate
358 level of analysis is the individual or the group. Small-scale war typically occurs through a raids that lack
359 any overall strategic objectives. Instead of raids being directed towards advancing the strategic objectives
360 of the group, they are initiated to satisfy the often-short-term aims of the individual attackers, especially
361 revenge and status. Although I focus on small-scale societies, similar dynamics are often found in
362 decentralized urban violence (Buford, 2001; Mays, 1997; Shakur, 2007). Thus, the most appropriate level
363 of analysis for the conditions of war in decentralized small-scale societies is the individual. It is the
364 individual, not an organization that decides to initiate war.

365

Despite the differences between state and decentralized war, there are important similarities in the logic of war and peace. For both decentralized and centralized societies, peace is often more beneficial than war for both the group as a whole and the individuals within the group. Because of this, individuals often seek to maintain peace and prevent conflict. Many of the primary drivers of war are the same between decentralized and centralized societies (Blattman, 2022; Schelling, 1980): individual actors who are able to initiate conflict without feedback from the group, such as group of young men who decide attack their neighbors in the case of a small-scale society or an authoritarian leader in control of the military (Putin) (Kleinfeld, 2019); incentives for war that can't be shared with the other group or are intangible, such as revenge or status (Levy, 1998); and finally commitment problems. Groups cannot necessarily trust that their adversaries will honor their commitments towards peace, and to assume that the other side has cooperative non-aggressive intentions may leave them open for attack (Powell, 2006; Walter, 2009).

3. PREREQUISITIES FOR PEACE

Given the difficulties in creating and maintaining peaceful relationships, I now consider the conditions that enable them. I will argue that intergroup peace in humans required evolving the psychological capacity to tolerate strangers and developing the social mechanisms through which interactions between members of separate groups are governed by norms that stipulate non-aggression. At the same time, when conflicts do emerge, societies require mechanisms to resolve them and signal future cooperative intent. These systems need to have both enough resilience to withstand inevitable conflicts, and the ability to keep dyadic conflicts from spreading beyond the original parties and becoming coalitionary.

3.1. Capacity for Tolerant Interactions

Peace requires the psychological capacity for tolerant, non-aggressive interactions that cross group boundaries. While humans clearly have this capacity, many social species lack this ability. Chimpanzees, for example, rarely have tolerant inter-community interactions; instead they usually avoid each other and

when an imbalance of power exists, the larger group often aggresses the smaller group (Wilson & Wrangham, 2003). While bonobos do have intergroup aggression, they also have tolerant and cooperative intergroup relationships that can involve copulation and occasional food sharing. The fact that bonobos have intergroup tolerance suggests that the capacity for tolerance between groups may have developed early in the hominid lineage or even predate it. Once a capacity for tolerance was in place, social conditions such as the expansion of kinship networks (Chapais, 2009) or sanctions against overly aggressive individuals (Boehm, 2012b; Wrangham, 2019) may have further increased our ability to tolerate strangers. Regardless of when a human capacity of tolerance emerged, intergroup cooperation requires the ability to tolerate strange individuals, something our chimpanzee cousins are incapable of. Thus, identifying when and how this ability arose will provide insight into the first crucial step necessary for peaceful intergroup relationships.

3.2. Payoff Structure Favors Cooperation

"War was not perpetual… Truces for hunting seasons were often made in the hunting areas between the combatants." (Hickerson, 1962).

Peace requires the psychological ability to tolerate strangers but tolerance itself is not sufficient for peace. Peace also requires the *motivation to interact* with members of other groups (unlike most social species who generally avoid other groups). Positive intergroup interactions will be favored when individuals of both parties can benefit from their interactions, such as by accessing resources that would otherwise be unavailable (Pisor & Gurven, 2016, 2018). In non-human social animals, the potential benefits from intergroup interactions include opportunities to interact with potential reproductive partners, infer information about groups for future transfers, or learn about the relative size and strength of neighboring groups (Pisor & Surbeck, 2019). These potential benefits would apply to early humans. However, as early humans developed a more specialized subsistence niche, especially one that depends on complementarity

(extra-household food sharing) and cultural technologies (spears, traps, tracking), the potential benefits would have expanded leading to increased incentives for intergroup cooperation.

The creation of interdependencies would have greatly amplified the potential payoffs for intercommunity cooperation. A common form of interdependency among subsistence societies is one in which groups that depend on unpredictable and variable resources allow others to access resources in their territory in time of need, such as water, game lands, or grazing (Cronk & Aktipis, 2021; Glowacki, 2020; Kelly, 2013; Pisor & Jones, 2021). A potentially more important form of interdependence would have developed when groups began to rely on non-local resources or goods that other groups had access to and that could be procured through trade or social relationships (Schulz, 2022; Smith et al., 2022). In small-scale societies, these include material goods, such as tools, stones for toolmaking, and ochre, as well as cultural knowledge including religious, ceremonial, or ritual information.

If intergroup conflict disrupts access to goods or other benefits from other groups, group members have a strong incentive to avoid conflict. This occurred in the Solomon Islands, for example, where "it must have required extraordinary self-control… to withstand the tantalizing temptation of having a go at each other. The remarkable thing is that peace of any duration obtained. What probably occurred was that each side badly wanted what the other had to offer; these considerations overrode appetites for bloodletting for more or less extensive periods of truce." (Oliver, 1955, p. 296).

3.2.1. *Specialization can fuel peace*

Increasing material and cultural complexity often expands the opportunities for interdependence between groups (Ringen et al., 2021; Spielmann, 1986), increasing the potential payoffs from intergroup cooperation. Groups that rely on or value a greater range of materials, specialized tools, technologies, or immaterial cultural items, such as ritual or religious knowledge, experience potentially increased payoffs

from intergroup cooperation. As groups can increasingly provide each other with valuable goods, information, or support, there will be more attempts at preventing conflict and restoring relationships afterwards (Garfield et al., 2019). Highly interdependent regions often developed ritualized trade and exchange systems to maintain peaceful relationships, such as the White Deerskin Dance (W. R. Goldschmidt & Driver, 1940), the Potlatch (W. Goldschmidt, 1994), and Kula Ring cycle (Malinowski, 1920).

3.3. Norms Promote Intergroup Interactions

The capacity for tolerance and the possibility of benefiting from interactions with outgroups creates the conditions for intergroup cooperation of the type seen in bonobos, but these alone are insufficient for peace. When severe or lethal violence is a possibility, as in chimpanzees and many human groups, individuals are more likely to avoid interactions or even engage in preemptive aggression. Thus, peace also requires the ability to have reasonable expectations about whether interactions with outgroups are likely to be neutral, aggressive, or positive (avoiding neutral and aggressive interactions and seeking out positive interactions). This depends on the ability to predict both the behavior of one's own group members and the behavior of members of the other group. But how do we do reasonably anticipate the behavior of our group members and members of other groups? We do so by adhering to and enforcing norms regulating the behavior of our group members with the knowledge that the other group is doing the same.

3.3.1. *Norms Reduce Uncertainty in Intergroup Relationships*

The vast scale at which humans cooperate with both ingroups and outgroups is fundamentally different than any other vertebrate species. This ability is enabled by a uniquely human capacity for norm compliance and enforcement (Chudek & Henrich, 2011). Norms are prescriptive rules or expectations about behavior that are *known* by members of a community and *enforced* by the community (Knight, 1992). Accordingly, with norms in place, community members are expected to act in socially prescribed

ways, they and other community members are aware of these prescriptions for behavior, and deviations from them these prescriptions enforced, often through external mechanisms that include some form of sanctions.

Norms mitigate the threat that potential aggression imposes on intergroup relationships because they can stipulate both how oneself and one's group members should treat members of other groups (such as with aggression or non-aggression) and how members of another group should treat oneself and one's own group members. Once norms governing intergroup behavior develop, they reduce the likelihood of unanticipated aggression for two reasons: 1) Norms allow individuals to calculate the anticipated payoffs of intergroup interactions based on the behavior of their group members and the behavior of the outgroup (whether members of either group are likely to use aggression). Being able to assess how an intergroup interaction is likely to unfold promotes the interaction of strangers by removing uncertainty about the outcome of the interaction (whether it is likely to result in violence). 2) A critical threat to positive intergroup relationships occurs when one individual behaves in a manner that can be interpreted as being threatening or hostile. Norms buffer against the overinterpretation of the behavior of any one individual who may do something conflictual and provide a chance for the offending group to restore the relationship by enforcing the norm with sanctions. Thus, in interactions between members of two groups, if one individual does something aberrant, a reasonable inference is that the individual is not adhering to the norms governing intergroup interactions, rather than assuming that behaviors of other group members will be similar. Thus, norms facilitate intergroup interactions by increasing resilience if an actor deviates from the norm.

Consider two groups of strangers who meet for the first time with no prior knowledge of each other. Individuals have few, if any, expectations about how they will be treated by members of the other group (e.g., whether they will be treated as a friend, ally, enemy, or potential threat). They also lack expectations

about how they should treat the members of the other group (e.g., with wariness, warmness, or hostility). In such cases, each interaction is negotiated spontaneously and tentatively, as in primates, as each individual seeks to determine the likely behavior of out-group members and then adjusts their own behavior based on the signals and cues they detect from others in their group and the outgroup. Interactions may be cooperative, or they may be conflictual; some individuals may be aggressive and others pacific; and the state of interactions often quickly changes. A small conflict can easily lead to a breakdown of the relationship. Norms solve the problem of uncertainty in interactions by providing guidelines about how oneself and one's group should treat members of the other group but require confidence that the other group holds similar norms.

An overlooked but critical aspect of norms is that they require seeing members of a group as just that, members of a group and not merely a collection of individuals, often termed social identity (Moffett, 2013; Smaldino, 2019). Because norms require knowing how members of a group should act, they require the psychological ability to categorize persons, including oneself, as members of a group (Hechter & Opp, 2001; Sripada & Stich, 2005), and the social structures to demarcate groups as distinct. Group identification may be based on physical features such as proximity, residence, or relatedness, or social structures such band or clan membership, indicated through dress or decoration. The capacity to identify ourselves and others as members of social groups that share certain properties allows us to interact with strangers not just as strangers; instead, we can base our treatment of them on their group membership and expect them to do the same in return (Lew-Levy et al., 2018; McElreath et al., 2003; Pope-Caldwell et al., 2022). Once norms governing relationships with outgroups are in place for both interacting groups, individuals can be reasonably confident about how they will be treated by members of the other group and able to calculate whether the interaction will be positive.

The key insight is peace requires that individuals be able to not only tolerate and benefit from interacting with strangers but anticipate that the interactions will be non-aggressive. Doing so on an *ad hoc* basis, such as when two groups of primates encounter each other often leads to avoidance rather than cooperation. If interactions do occur, they are usually tentative and commonly involve aggression, thus easily breaking down, as in bonobos. But once humans evolved the ability to identify themselves and others as a member of group and to enforce norms, the conditions were in place for the development of norms about how to treat outgroups.

3.3.2. *Norms to Promote Peace and Punish Spoilers*

When I asked the Bodi, 'will there be an end to the killing and warfare if you get many cattle and abundant pasture?' they replied 'no, it will go on forever.' (Fukui, 1994)

Norms about how to treat outgroup members may stipulate non-aggression, which promotes peace, or they may endorse violence towards outgroup members which drives warfare. In small-scale traditional societies, violence towards outgroups was frequently tolerated or even rewarded through cultural incentives (Otterbein, 1989). Multiple studies have found that the presence of norms for violence are associated with increased warfare and a lack of peace (Fry et al., 2021; Glowacki & Wrangham, 2013; Goldschmidt, 1994). The key challenge is for societies to prevent or replace norms that reward aggression, such as through providing status to aggressors, with norms that prohibit aggression and implement coercive sanctions for those who violate them. Fortunately norms can change and norms prohibiting violence can be adopted quickly (Pinker, 2012). In small-scale societies, shifts in norms towards non-aggression are often led by prominent individuals who negotiate for peace, renounce war, or refuse to honor warriors with blessings or other cultural rewards (Fry et al., 2021; Glowacki & Gonc, 2013; Glowacki & von Rueden, 2015; Strecker, 1999).

Norms for non-aggression towards outgroups require enforcement, often through sanctions against individuals who violate these norms. Strong sanctions for norm violators are difficult to enforce in small-scale decentralized societies, especially more egalitarian ones because punishment itself imposes costs, including the loss of a potential group member if the sanctioned individual changes their group residence (Baumard, 2010; Wiessner, 2005). These societies can impose reputational sanctions, exclusion, or ostracism for norm violators, but these are often less effective than strong sanctions, such as fines, physical punishment, or even execution for those who break the peace.

Severe sanctions for norm violators typically occur in more complex societies with structures promoting social solidarity, such as age-sets, that invests a group of coevals with authority over their members (Garfield et al., 2022; Mathew & Boyd, 2011). Age-mates may be motivated to sanction peers who violate important norms, including breaking the peace, because the norm violation imposes reputational damage on the rest of the age group, thus avoiding the second-order free-riding dilemma. (Baumard & Liénard, 2011; Liénard, 2016). Similarly, in societies where older men yield significant social and political power, they may also be able to impose severe sanctions on peace violators. For instance, among the Daasanach of southwest Ethiopia "approximately 150 young Daasanach wanted to go to war… The plans of attack were disclosed and all the other age-sets… beat the youngest men with sticks and made them withdraw their plan" (Sagawa, 2010, p. 101). Preventing unilateral aggression thus requires not only a general absence of norms towards unprovoked violence, but it also requires the will and capacity to sanction group members who seek war unilaterally.

3.4. Mechanisms to Resolve Conflicts

"The Hamar are an eternal enemy, and between them and the Mela there are no means of settling conflicts and making peace." (Fukui, 1994, p. 37)

Resolving conflicts is the most serious challenge to the development and maintenance of peace in small-scale societies. Conflicts often spread beyond the original parties to include the larger social group creating a cycle of tit-for-tat violence making resolution even more challenging (Garfield, 2021). Even when individuals who have been aggrieved do not wish to seek revenge, the social pressures to do so may be enormous. There also exists the possibility that unintentional harm caused by outgroup members will be misinterpreted as having aggressive intent, triggering intergroup conflict.

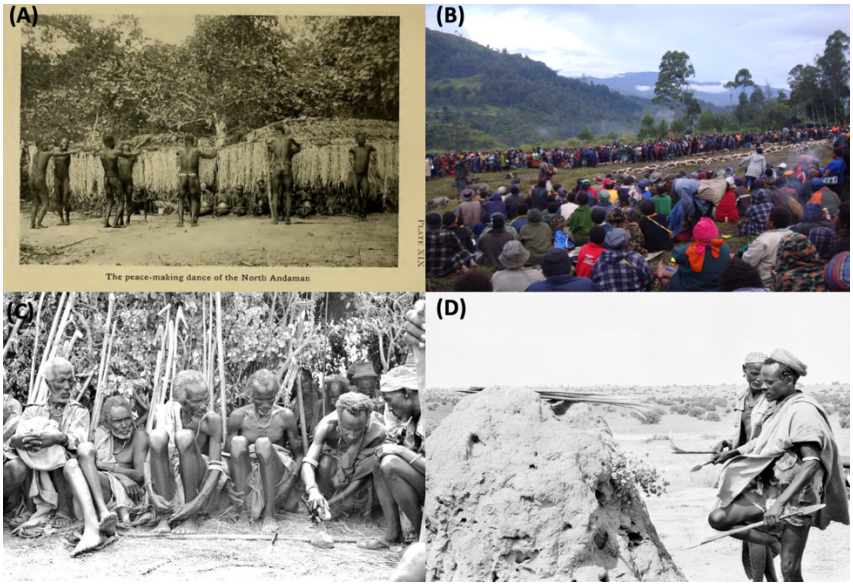

Figure 2: Examples of Peace-Making Rituals *(A) Andaman Islands: peace-making involves a ritualized dance between hostile groups where aggressive feelings are displayed culminating in an exchange of weapons (Radcliffe-Brown, 1922). (B) Enga: distribution of compensation after a death, approximately 100 pigs were slaughtered and money distributed (Courtesy of Polly Wiessner). (C) Peace agreements with Arbore and other groups in southwest Ethiopia involve symbolically blunting spears and (D) then breaking and burying the broken spears (Streker & Pankhurst, 2004).*

3.4.1. *Restitution and Signaling Cooperative Intent*

"War [can be] triggered by an individual, [but] peace can only be re-established communally"

(Girke, 2008, p. 202)

584 The key challenge after intergroup conflict is to prevent members of the aggrieved group from taking
585 revenge. This often requires restitution to the aggrieved party for the harm they have suffered [See Table
586 2]. This may involve in-kind exchanges, such as replacing stolen livestock with other livestock or the
587 utilization of different currencies, such as providing the aggrieved group with a person from the offender's
588 group (usually a young woman). Because blame is often ascribed to the group rather than the individual,
589 restitution frequently comes from members of the perpetrator's group, rather than from the perpetrators
590 themselves.
591
592 Not only does the offending group have to offer restitution, but the aggrieved group must accept it as
593 satisfactory. This negotiation provides another arena for conflict between groups as they determine an
594 adequate level of restitution that satisfies both groups. For example, among the Kalinga, "kindreds [of the
595 victim] are rarely satisfied with simply being paid off, and often retaliate by a counter-killing" (Dozier,
596 1967, p. 93). Reaching satisfactory compensation can be difficult, especially when tensions between
597 groups are high.
598
599 At the same time, the offending group needs to signal cooperative intent, e.g., that future interactions are
600 likely to be positive and that the offender's actions do not represent a new norm on the part of the
601 offender's group (Roscoe, 2013). The need to signal cooperative intent is why peacemaking after a violent
602 conflict often requires that the offending group execute one of their own group members. For example,
603 among the Curripaco "lineage members decided to execute ritually their kinsman who had killed, rather
604 than provoke a spate of tit-for-tat revenge killings" (Valentine, 2008, p. 36). While among the Erbore of
605 southwest Ethiopia, one elder reported "We brought about peace by allowing two Erbores…to be killed
606 by our enemies. I, myself, have handed over one of our sons to be killed" (Sullivan, 2008, p. 16). Drastic
607 actions such as the execution of the offender can signal to the aggrieved group that future interactions are
608 likely to be positive.

609

610 Because restoring or creating peace requires the community to reaffirm norms of cooperation and non-
611 aggression towards the outgroup, peace-making often involves many people from both groups meeting to
612 discuss the conflict and its resolution, often engaging in symbolic ceremonies indicating resolution (Table
613 1). This will commonly involve eating and drinking together, as well as rituals that symbolize that the
614 conflict has been resolved and neither party desires revenge. Groups may break or bury items related to
615 conflict such as spears or weapons, believing that peace may hold as long as these items remain buried
616 (Strecker, 1999). Symbolic gifts may be given between members of the opposing groups that indicate a
617 desire for peace (Bacdayan, 1969). Such traditions also exist in centralized societies, including states, with
618 militaries often indicating surrender by turning over ceremonial swords.

619 **Table 1: Common Conflict Resolution Mechanisms**

Symbolic Ceremony	1. *Sama Dialut* – a coconut-splitting ritual ceremony involving prayer that culminates in enemy parties resuming speech with each other (Sather, 2003). 2. *Rotumans* – an apology that varies based on the seriousness of the offense and can include gifting the other party a cow, presenting a specific drink, or wearing ritual leaves (Howard, 2003). 4. *Ojibway* – leaders exchange goods such as guns, clothes, and pipes with the enemy, then eat/smoke from the same plate/pipe for a set amount of time (Warren, 1885). 5. *Andaman Islanders* – dance ceremony where the "forgiving party" dances into camp making threatening gestures towards the other group. Afterwards both parties exchange weapons (Radcliffe-Brown, 1948).
Wergild (compensation for harm done)	1. *Santa Cruz Islanders* – an exchange of a pig to compensate for damage (Davenport, 1969). 2. *Curripaco* – exchange of a woman or future child to resolve conflict over land (Valentine, 2008). 3. *Tlingit* – exchange of blankets and an enslaved person, to compensate for the loss of a life (Jones, 1914). 4. *Murngin* – sending food and tobacco to the injured group; every member of the clan must partake (Warner, 1931).
Mock or ritualized conflict	1. *Yukpa* – use of corncob arrows (Halbmayer, 2001). 2. *Northwest Amazon* – enactment of warfare before gifting (Chernela, 2008). 3. *Ona – Jelj*: shooting arrows without arrowheads between enemy parties (Bridges, 1949). 4. *Murngin* – ritualized spear-throwing between groups, towards the aggressor (Warner, 1931).
Ingroup sanctions	1. *Curripaco* – killing those who had killed previously (Valentine, 2008).

	2. *Daasanach* – those who disturbed the peace had their animals killed as punishment (Houtteman, 2010). 3. *Kapauku* –responsible party has to pay or be given to the enemy to be killed (Pospisil, 1994).

620

621 **3.5. Third-party Mediators and Leadership**

622 We have seen that restoring relationships after a conflict requires the ability to sanction peace violators,
623 the coordination of compensation between groups, and the ability to signal cooperative intent. These are
624 difficult conditions to satisfy especially in the context of an ongoing conflict. Two factors can greatly
625 increase the likelihood of peace: leadership and third-party mediators. Despite the potential efficacy of
626 leadership and strong third-party mediators, small-scale decentralized societies often lack strong
627 leadership and third-party institutions due to their egalitarian nature.

628

629 Leadership facilitates peace because individuals who wield asymmetric power can prevent war or establish
630 peace using their influence over others in a way that is not often available in hierarchy-free societies (such
631 leaders can also use their influence to motivate warfare) (Garfield et al., 2020). As a result, peace efforts in
632 small-scale societies are frequently led by prominent individuals who motivate ingroup members to
633 maintain peace, sanction offenders, and negotiate with outgroup members (Fry, 2007; Fry et al., 2021;
634 Glowacki & Gonc, 2013). Some societies institutionalized the role of peacemaker into a position such as
635 a peace chief or peace leader (Bacdayan, 1969; Goldschmidt, 1994; Moore, 1990), who "appeared at the
636 scene of battle… and attempted to induce disputants to come to amicable agreement" (Goldschmidt,
637 1951, p. 326). However, these kinds of formal peace leaders occur more frequently in societies with
638 significant social stratification such as the Kalinga and Cheyenne. The absence of prominent leadership
639 who can negotiate for peace is a key impediment to the development of peace in decentralized societies
640 with intergroup conflict.

641

Third parties have an important role in restoring relationships after conflict in small-scale societies, whether within or between groups (Fitouchi & Singh, 2022; Hoebel, 2009). Third-party mediators may be customary leaders or institutions, such as groups of elders or other bodies of prominent individuals, while in contemporary contexts they are often government representatives or non-governmental organizations. They often facilitate the negotiations about compensation and restitution such that they are acceptable to both parties, rarely relying on punishment for restoring relationships (Fitouchi & Singh, 2022; Singh & Garfield, 2022; Wiessner, 2020). The absence of strong third-parties to facilitate conflict resolution can be a serious impediment to peace. For example, among Wanggular of Melanesia "De-escalation was difficult…. There was no intermediary party… who could assist the two hostile parties to agree on the size and content of the payment…. Thus it seemed almost impossible for Wanggularm to settle quarrels" (Ploeg, 1979, pp. 170–171).

Box 1. Anatomy of a Cycle of Peace and Conflict

I highlight the key events in a cycle of peace and conflict during a several-month period between the pastoralist communities in southwest Ethiopia/ northern Kenya. All four groups discussed below retain strong customary institutions.

Spring 2011: An Ethiopian non-governmental organization hosts a multi-day inter-tribal peace meeting for the Daasanach, Nyangatom, and Hamar. The three groups agree to reconcile and make peace. Relationships are relatively calm.

Early August 2011: Daasanach kill 12 Turkana people, including 9 women and 2 children, and steal a number of livestock. Turkana retaliate by attacking the Daasanach. Cumulatively, 33 people are killed in the clashes.

Early August 2011: Drought decreases the area of viable grazing land, and the Hamar and Daasanach begin grazing livestock along their shared group borders. With closer proximity and a state of peace in place, they begin regular visitation and trade with one another. Intergroup relationships are positive, and people visit each other across group boundaries with little fear of attack.

August 21-23, 2011: To solidify positive relationships in the face of bubbling disputes, the Ethiopian government organizes peace meetings between the Daasanach and Hamar. They engage in rituals in which they bury their weapons and agree to continued peace. The elders who are present state that anyone who causes conflict should be punished. A government official speaks at the proceedings, underscoring that peace will bring benefits to both groups. He also asks that the elders emphasize the importance of peace to the members of their communities. Finally, he stipulates that offenders will be punished as individuals (i.e., sentenced to prison) rather than through customary, community-based justice, which typically involves restitution through repayment of livestock.

August 30-31, 2011: Tensions have recently increased between the Daasanach and Hamar, so another peace meeting is held. The meeting includes traditional peace rituals in which sheep are slaughtered

and their blood poured into holes that they have dug in the ground. The blood is covered with soil. Although sheep intestines are typically eaten, the peace ritual requires that they instead be buried in a separate hole, symbolizing that the Daasanach and Hamar have no hunger for conflict or revenge. The fat of each sheep is separated, and a Daasanach elder holds fat from a Hamar sheep and vice versa. Then, each hangs the fat around the other's neck, and they wash their bodies with a mix of water and milk. This symbolizes their reconciliation.

The next day, elders on both sides speak. The Hamar elder states: "…*The youth are the ones who are killing and stealing so they should be careful not to create more problems. We will punish those who will not listen to us according to the laws of our culture. Therefore, what I want from now on is to live with the Daasanach as one*." The Daasanach elder replies: "*All we want is peace, so after concluding this meeting we will gather and speak to the youth. We will punish anyone who does not listen to our words according to the laws of our culture.*" A high-level representative from the Federal Government closes with the following remarks: "*Don't think that you can kill and steal as you please like before. That is in the past. Now, a person who has done wrong will be prosecuted by law. Where you come from, when a person kills another he is awarded high honors by family and relatives. Their mother, father and wives become famous. That's why clashes continue. So women must stop doing such things, as it's their praise that leads men to committing crimes*."

Early September 2011: Despite the peace meeting several weeks earlier, tensions between the Hamar and Daasanach have increased. Another peace meeting is held on the border between Hamar and Daasanach to head off conflict. A Hamar elder begins, saying, "*This land is ours. Why did you come here*?". The Daasanach elder replies, "*This land is ours, not yours, so we can graze cattle where we want*." At this, young Hamar men in attendance pick up their AK-47s. Government administrators intervene, asking the Daasanach youth not to pick up their weapons. After tempers cool, the youth of both groups are sent away. The remaining elders cannot reach an agreement and decide to meet again at a later date.

September 17, 2011: While the Hamar and Daasanach are watering their cattle together at a common watering hole, a Daasanach man arrives and shoots and kills a Hamar man. The attacker then flees into the forest. The two groups separate their cattle and depart to their separate territories, and this is the end of their co-grazing.

September 21, 2011: The Daasanach, Nyangatom and Turkana have a peace meeting in Kenya.

September 24, 2011: Five Hamar youths take revenge for the death of the Hamar man earlier that month and kill a young Daasanach man tending cattle.

Fall 2011: Group relations continue in a similar cycle, fluctuating between conflict and peace.

4. THE TENSIONS BETWEEN WAR AND PEACE

The social dynamics leading to war and peace in small-scale societies are complex and societies are often in tension as their members struggle to balance the potential costs and benefits that can come from war and peace. The payoffs to war and peace vary by individual, the nature of conflict, and the specific out group. Although war often imposes collective costs, non-participants, such as older adults may benefit from war if they can use it to satisfy their material or political goals and hence encourage young men towards war. Among pastoralists in East Africa for instance, male elders often receive a share of captured

livestock thus creating an incentive for them to encourage youth to raid (Glowacki & Wrangham, 2015) while in Big Men societies war may be used to advance the political or economic goals of individuals who then incite young men to war (Koch, 1974; Meggitt, 1977). Women may also sometimes benefit from offensive warfare, either from access to spoils, or the status that may come from being associated with a prominent warrior. At the same time, some individuals may benefit more from peace than others, either by using the peace process to advance their political or economics aims or establishing themselves as a prominent individual who is able to negotiate for peace (Wiessner, 1998)[4]. These competing tensions between war and peace create a complex social dynamic where individuals or factions may simultaneously benefit from war while recognizing the harms that come from increased warfare, including retaliation, loss of intergroup trade, and disruptions to their livelihoods [see (Almagor, 1979; Wiessner, 2019) for detailed ethnographic descriptions of these tensions].

As decentralized societies begin to develop internal social structures, including age or status groups, or informal but powerful leadership either through groups of elders (gerontocracies) or specific individuals (Big Men, proto-Chiefdoms), the conditions in which war can be used to advance the strategic aims of the group become possible and can approach those found in state societies (Blattman, 2022; Schelling, 1980). For example, the Enga in Papua New Guinea have powerful Big Men who wield large amounts of influence and sometimes use war to advance the group's aims, including leveling imbalances of power when other groups began to gain an advantage. "Warfare was one means to counter unequal development by torching the schools or aid posts of neighbors, destroying coffee gardens and stores…" (Wiessner, 2006, p. 181). When war is used to advance the aims of the group, then models of war that are typically

[4] During my field research a prominent elder of one of the groups I worked with was well-known to NGOs as an advocate for peace. He used his relationship with NGOs and participation in peace meetings to advance his standing with the government and NGOs. I witnessed several occasions where he returned from a peace meeting and soon after advocated for responding to neighboring groups with aggression. He was ultimately killed in a raid he led against a neighboring group.

applicable to states become more appropriate, including models that see war as arising from imbalances of power between groups or security dilemmas (Blattman, 2022; Posen, 1993; Wagner, 1994).

5. STATE INTRUSION AND PEACE

In the absence of strong mechanisms to prevent and resolve conflicts, especially ones robust enough to restrain the impulses of youth, it is extremely difficult for groups to achieve and maintain peace. Thus, many small-scale societies were often locked in cycles of tit-for-tat violence from which it was nearly impossible to escape. "Revenge raids often spiraled out of control and retaliatory actions assumed a pathological character" (Gabbert, 2012, p. 238). The "Suri survivors do feel the loss and they do see the problem, but they don't know how to stop [it]." (Abbink, 2009, p. 33). "We tried to stop killing… then someone would kill and we would return to killing back and forth" (Boster et al., 2004, p. 481). Among the Waorani, "one group would invite another to a drinking feast where both would pledge to end their vendettas… The results were often disastrous… as likely as not the visitors would be ambushed on their way home by hotheads… There was, in short, no safe way to establish initial peaceful contacts between enemies or promote the growth of trust" (Robarchek & Robarchek, 1998, p. 156). As a result, significant exogenous shocks that alter incentive structures are often necessary to precipitate the development of peace and contact with states is the most significant of these.

Contact with states and colonizing institutions, such as missionaries, is rightfully recognized as a destabilizing, and often destructive, force on indigenous societies, sometimes including short-term increases in violence as societies react to new pressures (Ferguson, 1988; Ferguson & Whitehead, 1992). While states would often use violence to regulate the behavior of the groups they sought to control, there is overwhelming evidence that initial contact with states is often, with some exceptions, followed by a dramatic reduction in violent inter-tribal hostilities (Helbling, 2006; Helbling & Schwoerer, 2021; Rodman & Cooper, 1983). In South America among the mobile foraging Ache, for example, "What had

been unthinkable when all the Atchei were living independently in the forest—their reconciliation… came about once they had lost their freedom" (Clastres, 1998, p. 100), while in the Arctic "some Yupiit believe that the Russians are really the only reason the Bow and Arrow wars ended" (Funk, 2010, p. 557).

The reduction in intertribal violence is often viewed positively by community members. After the Australian government prohibited raiding among the Tiwi, "some of my older informants considered it a blessing when the pattern of sneak attack was terminated in 1912." (DeVore & Lee, 1968, p. 158). The Gebusi in New Guinea went from "intense intercommunity… lethal violence… to exhibiting a homicide rate that has dropped to zero" where "agents of colonial intrusion were seen as powerful benefactors if not saviors" (Knauft, 2011, p. 220). In South America, "as they [the Waorani] began to realize that the feuding could stop, some members… began urging their kin to heed the words of the missionaries" (Robarchek & Robarchek, 1998, p. 156). While among the foraging !Kung, "…many speak of the bringing of the *molao* (law) to the district as a positive contribution of the Batswana" (Lee, 1979, p. 396).

States create several pathways to reduce intergroup conflicts. First, states often create formal conflict resolution mechanisms with coercive authority and apply sanctions to those who violate intergroup peace. Second, in small-scale societies, war is often an important or primary pathway to status and wealth and incorporation into state society provides a new arena to compete for wealth and status. Among the Bokondini with the arrival of colonial government, "the most important traditional avenue to becoming prominent was cut off…. The mission teachings, on the other hand… opened an alternative to gain prestige" and "it is likely… that they [young men] thought they would gain prestige by being active mission preachers" (Ploeg, 1979, p. 176). Contact with states also imports new values that may provide an alternative to those that promote war. Among the Waorani, who previously had some of the highest rates of lethal violence for any society, "What they [missionaries] provided was new cultural knowledge—new information and new perceptions of reality—that allowed a reorganization of both cultural and individual

738 schemata…they were able to imagine and to seek a new world, one without the constant fear of violent
739 death. In a matter of months, the Upriver band abandoned the pattern of internal and external raiding
740 that had persisted for generations" (Robarchek & Robarchek, 1998, p. 157).
741
742 States also provide access to valuable new goods. For the Kutchin, "why did the two peoples stop
743 fighting…? It is likely, that the natives…. saw trading and trapping as more profitable than fighting"
744 (Slobodin, 1960, p. 90). For the Enga, peace followed shortly after contact, when the Australians "gave
745 beads, salt, steel axes—everyone wanted it so they all followed the Kiap [Australians] and stopped
746 fighting. *We stopped fighting because we did not want to lose the source of these things*" (Podolefsky, 1984, p.
747 75). In the Arctic "a desire for the newly arriving Western goods replaced the raiding parties with trading
748 parties and hostilities… transformed into different forms of competition in the new economic situation
749 (Funk, 2010, p. 557). Finally, among the Hor of Ethiopia, "[new] developments also can be advantageous
750 for the peace process, e.g., when new fashion items substitute for killing emblems, and when guns and
751 bullets are sold on a large scale by young Arbore in order to buy mobile phones and pay their telephone
752 costs" (Gabbert, 2012, p. 244).
753
754 State institutions commonly allowed actors who were traditionally excluded by indigenous institutions,
755 such as women and youths, to participate in the peace process (Figure 3). For example, during a 2006
756 peace meeting in the Omo Valley, when women spoke to the groups assembled one reported "we are sick
757 and tired of the attacks on us and our children… men solve their problem and later on the problem
758 returns. We ladies are arguing… *they should give us the chance* [to make peace]" (Sullivan, 2008, p. 20). In
759 Papua New Guinea, in the middle of a tribal battle "women walked into the middle of a battlefield
760 between opposing sides…. They offered the men payments of foodstuff, money, cigarettes and soft drinks
761 to lay down their arms. The women were members of a woman's club… associated with 'governmental
762 law' and business, which were then seen as impartial yet powerful forces (Henry, 2005, p. 434).

Figure 3. Peace-making in contemporary societies. *Women and youths are typically excluded from customary forms of peace-making in many societies. Contemporary peace-making initiatives actively work to involve all sections of communities. At an inter-tribal peace meeting in the Omo Valley A) Nyangatom women speak about their desires for peace. B) Male youths indicate their desire for peace. Photos courtesy of Sylwia Pecio.*

6. WHEN INTERGROUP COOPERATION AND PEACE EMERGED

Despite the uncertainty regarding when war evolved in our pre-human ancestors, we can make reasonable inferences about the development of cooperative and peaceful intergroup interactions among early humans based on archaeological and morphological evidence, studies of recent foraging groups, and game theoretical considerations such as those presented above. Did the last common ancestor have the capacity for tolerance towards strangers like bonobos, or exhibit reliable hostility and aggression like chimpanzees? The answer depends on which species makes a better model for the last common ancestor; regardless, the fact that bonobos exhibit high levels of tolerance towards outgroup members indicates that tolerance could predate the *Homo* lineage. The benefits of tolerant interactions would have greatly increased once humans developed the use of language, when interactions with nearby communities would have provided opportunities to share valuable information about territory, resources, or the behavior or location of other communities, or coordinate and plan activities such as group hunting or resource management (Wilson, 2013).

Paleo-archaeology provides clues as to when repeated cooperative intergroup interactions first became important in the human lineage, particularly through long-distance exchange networks. While the

786 paleoarchaeological record reflects preservation bias and estimates are likely to be revised when new
787 evidence emerges, it at least provides a baseline to date the development of cooperative relationships
788 between groups (Tryon & Faith, 2013). Prior to 700,000 years ago, there is little evidence that our
789 hominin ancestors engaged in or would have needed to engage in intergroup cooperation and avoidance
790 of other groups was probably a common strategy due to the risk of being killed or injured in intergroup
791 interactions. The fact that early *Homo*, unlike chimpanzees or bonobos, used sophisticated tool such as
792 hand axes or spears (Ambrose, 2001), would have made intergroup interactions more perilous than in
793 primates, as a single individual from another group could inflict potentially lethal violence (Johnson &
794 MacKay, 2015).
795
796 The patterns of intergroup interactions began to change around 615 to 499,000 years ago, when early
797 humans began to acquire lithic materials from more distant sources (Potts et al., 2018) with some
798 evidence of occasional long-distance transport (Clark et al., 1984; Féblot-Augustins, 1990). The increased
799 reliance on non-local materials suggests that these early humans were expanding their ranges, becoming
800 more likely to encounter and interact with other groups and creating benefits to sharing information
801 about techniques and locations of materials.
802
803 **6.1. Intergroup Cooperation in the late Middle Pleistocene**
804 Dramatic changes in early human behavior began around 300,000 years ago. Some of the earliest reliable
805 evidence of regular long-distance transport of stone materials appears between 295,000 and 320,000 years
806 ago, with raw stone materials being transported more than 50 kilometers in straight line distance (walking
807 distance would have been much greater), exceeding the typical home range of 20 kilometers of many
808 recent hunter-gatherers (Brooks et al., 2018). Similarly, at the Sibilo School Road Site in Kenya, there is
809 strong evidence for long-distance transport of stone materials dating to more than 200,000 years ago from
810 sources located 25k km, 144 km, and 166 km away. Surprisingly, most of the transported obsidian is from

811 the farthest source at 166km away, not the closest source at 25km away (Blegen, 2017). The distance
812 these materials were transported is far greater than the estimated home ranges of forager bands and is
813 more consistent with the exchange networks for modern hunter-gatherers, which could involve scores of
814 people across hundreds of miles (Ambrose, 2012; Bird et al., 2019; Yellen & Harpending, 1972). This
815 kind of resource movement suggests "intensive, perhaps even obligate intergroup exchange rather than
816 down-the-line-exchange" such as the exchanges that characterize the Kula Cycle (Ambrose, 2012, p. 65).
817 Around the same time, the use of ochre was increasing, and by 300,000 years ago it was in regular use in
818 some regions, with much of it also being transported long distances, at a minimum of 38km but
819 potentially up to 170km away (Watts et al., 2016).
820
821 Increases in intergroup exchange around 300,000 is paralleled by skeletal changes in the human lineage
822 towards increasing gracility. Skeletal and cranial gracility is often used as a proxy for reduced reactive
823 aggression, (Chirchir, 2021; R. Wrangham, 2019). Reduced reactive aggression allows for increased
824 outgroup tolerance, enabling affiliation with strangers. The earliest evidence for gracility among human
825 ancestors comes from archaic *Homo sapiens* around 320,000 years ago (Wrangham, 2019), around the
826 same time as the emergence of long-distance stone transport, suggesting that humans around this period
827 were becoming less reactively aggressive while simultaneously increasingly relying on intergroup trade
828
829 The development of long-distance transportation networks, increased selectiveness of stone tool materials,
830 bodily adornment with ochre, and reduced reactive aggression all around 300,000 years ago or earlier
831 suggests strongly suggests that the early human social environment was changing dramatically. These
832 changes would have both enabled and promoted positive intergroup interactions, leading groups of early
833 humans to seek out interaction with other groups they could possibly benefit from (Wilson & Glowacki,
834 2017). The payoffs from cooperation are significant enough that beginning around 300,000 years ago, the
835 ability to identify cooperative possibilities across intergroup boundaries would potentially have been a

836 selective force favoring increased prosociality (Hames, 2019; Wilson, 2013). Thus, by 300,000 years ago
837 at the latest, humans would have been capable of intergroup tolerance, relationships across group
838 boundaries would have at least been periodically cooperative, and these relationships would have provided
839 access to valuable resources including stone for making tools and ochre (Pisor & Ross, 2021)[5].
840
841 Peace, however, requires more than periodic cooperative intergroup exchange. It requires the
842 specialization to promote interdependence alongside social structures to develop and enforce group-based
843 norms, and prevent and resolve conflicts. Direct and circumstantial evidence in support of these prior to
844 the last 100,000 years ago are lacking. Given what we can reasonably infer about group size and social
845 complexity this deep in the Pleistocene, they were highly unlikely to be present. Societies at this time
846 were likely to be small and unstratified, with few means to regulate and enforce norms against intergroup
847 aggression and with little evidence of the types of specialization that would promote intergroup
848 interdependence. Without these social structures in place to regulate intergroup interactions, the
849 increased frequency of intergroup interactions during this period (300 kya to 100 kya) increases the
850 likelihood that some intergroup disputes would result in violence. Without the ability to prevent and
851 resolve conflicts, it would have been extremely difficult to turn periodic cooperative intergroup
852 interactions into the stable harmonious relationships required for peace.
853
854 **6.2. The Potential for Peace in the Late Pleistocene**
855 Our more recent evolutionary history provides strong evidence that humans were developing material and
856 social technologies that would have made peace more likely within the past 100,000 years. The
857 development of new lithic techniques and specialized hunting, as well as the regular exchange of stone,

[5] Thanks to Anne Pisor for suggesting that these might have also included long-distance ties between members of the same group.

858 shell, and ochre all during the last 100 kya (Foley & Lahr, 2003; Mcbrearty & Brooks, 2000) created the
859 conditions for high levels of interdependence, which is a crucial means of incentivizing intergroup
860 cooperation and preventing conflict. Between 75 to 100 kya there appears to have been a large increase in
861 the development of complex material technologies, status symbols such as shell beads, and symbolic
862 behaviors (Bouzouggar et al., 2007; Roberts & Stewart, 2018; Shipton et al., 2018). Access to the
863 materials and knowledge of how to produce these items would have increased the incentives for
864 intergroup cooperation to obtain these materials and the cultural knowledge of their manufacture and
865 meaning. The development of decorative and status items indicate that group identity and social
866 structures were becoming important, which enables the capacity for group-enforced norms and informal
867 leadership, both of which would have facilitated the emergence of peace.
868
869 Rather than intergroup relationships being mostly local, evidence of extremely wide-spread trade emerges
870 beginning 50,000 years ago when humans in East Africa began creating beads from ostrich eggshells
871 (Miller & Wang, 2021). Not only were ostrich eggshell beads traded, but a comprehensive study mapping
872 the spread of bead patterns across eastern and southern Africa found that beads were exchanged over an
873 area of *3,000 kilometers connecting both eastern and southern Africa (Fig. 4) lasting from 50-30,000kya* (Miller
874 & Wang, 2021). Even after this pan-African trade broke down, regional trade within eastern and
875 southern Africa over vast distances persisted until the present. Wide social networks like the ostrich
876 eggshell trade are consistent with ethnographically recent hunter-gatherers who also were embedded in
877 extensive exchange networks spanning hundreds of miles (Bird et al., 2019; Boyd & Richerson, 2022)
878 (Figure 4).
879

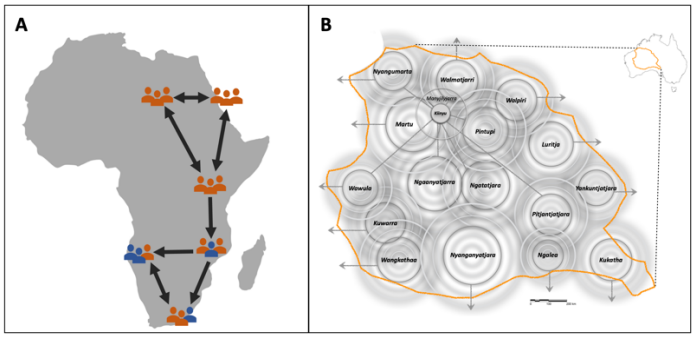

Figure 4: Long-distance Trade and Networks. *(A) Long-distance trade networks of ostrich eggshell beads connected eastern and southern Africa from 50-30kya. Reconstructed from Fig 4c in (Miller & Wang, 2021). (B) Hunter-gatherer social organization in western Australia where individuals are embedded in multiple levels of networks that span wide regions, including numerous language groups facilitating trade and the sharing of ritual knowledge. Courtesy of Douglas Bird.*

While we cannot confidently date the beginnings of peace, circumstantially, societies would have been able to create peace when they developed social structures that promoted high levels of interdependence, group-based norms, and socially integrative mechanisms to prevent and resolve conflicts. This likely began 100,000 years ago, when evidence of large-scale trade, cooperation, and increasing socio-political complexity emerges (Boyd & Richerson, 2022; Miller & Wang, 2021; Singh & Glowacki, 2021), though regular intergroup cooperation likely dates to at least several hundred thousand years ago. Once the positive benefits created through peace appeared, they would have created more selective pressure for the tolerance of strangers, affiliation across group boundaries, against reactive aggression, and cultural selection for the institutions and norms to promote conflict resolution.

The development of status items during the Late Pleistocene suggests the presence of cultural incentive systems for individuals who distinguished themselves. Based on this, we would expect that in addition to intergroup cooperation, lethal intergroup conflict would at least sometimes have occurred during this period, with the potential to become intense. This is supported by the fact that many recent hunter-gatherer and other small-scale groups have at least occasional warfare (Ember, 1978; Fry & Söderberg, 2013; Otterbein, 1989; Wrangham & Glowacki, 2012; Wright, 1942), while Boehm (2013) found that

nearly half of Late-Pleistocene Appropriate foraging groups in a sample of 100 societies had lethal intergroup conflict, though he argues this is an underestimate due to inadequate ethnographic accounts.

The intensity and importance of war during this period is uncertain but it likely occurred alongside the development of the capacity for peace. The presence of status items during the Late Pleistocene suggests the presence of cultural incentive systems for individuals who distinguished themselves. Cross-culturally among small-scale societies, war is the primary pathway to status for individual men, and status after age is the most important predictor of reproductive success (Hill, 1984; von Rueden & Jaeggi, 2016). In the few recent small-scale societies where it has been studied, participation in small-scale intergroup war appears to be associated with success in reproductive competition. Based on this, we would expect that in addition to intergroup cooperation, lethal intergroup conflict would have occurred during this period, with the potential to become intense.

Thus, it is reasonable to expect that when Pleistocene societies developed social structures similar to more recent small-scale groups, such as status hierarchies and social incentive systems, *intergroup coalitionary aggression as well as intergroup cooperation may have been a selective factor in our species' evolution*. Insofar as humans during this period resemble more recent small-scale societies, we would expect that intergroup cooperation would continue alongside intergroup conflict and that groups may have simultaneously had peace with one or more groups while also having conflict with other groups.

The timeline I have developed here is tentative and will likely be updated as new evidence emerges. I argue that by 300,000 years ago and until approximately 100,000 kya, early *Homo sapiens* had intergroup cooperation, including trade, that was likely to have been an important part of their livelihoods. However, without evidence for cultural and social complexity, we cannot infer that the conditions for high levels of interdependence or the social structures to prohibit violence or resolve conflicts existed during this period.

929 Thus, while intergroup cooperation occurred and may have been a selective force for increased prosociality
930 during this period, it was likely accompanied by at least intermittent intergroup conflict. Intergroup
931 conflicts would have been opportunistic, occasional, and low intensity, with one or two victims, as
932 opposed to the intense tit-for-tat raids seen among many contemporary small-scale societies. Beginning
933 sometime between 100-80 kya, or slightly earlier, humans developed the social structures and cultural
934 technologies to facilitate high levels of interdependence, creating greater benefits to cooperation, and to
935 regulate conflict through norms that prohibit aggression and can be enforced through sanctions. These
936 social structures would have created the conditions for societies to achieve peace, but also increased the
937 potential severity of conflict through creating group-based identities, norms that may award aggression,
938 and enabling the organization of individuals for aggression. Thus, from 100,000 years ago or so until the
939 rise of hierarchical centralized societies, intergroup relationships likely consisted of both war and peace
940 just as the more recent ethnographic record reflects.
941
942 **7. THE COEVOLUTION OF PEACE AND INTERGROUP CONFLICT**
943 I have argued that the form of intergroup violence our early human ancestors would have been most likely
944 to engage in is the raid, where a small-group of individuals attempt to attack and kill members of other
945 groups at low risk to themselves (Wrangham, 1999). Similar patterns are found in chimpanzees, wolves,
946 and some other primate species including spider monkeys. Raiding parties would have been initiated by a
947 small group of individuals acting in their own self-interest with little regard for the group's welfare. Raids
948 themselves would have had lacked significant coordination, structure, or complexity besides utilizing the
949 tactics of surprise and stealth. At the same time, human societies would have lacked internal social
950 structures or differences in coercive authority within age and sex groups, approximating the social
951 structure of more recent nomadic foraging groups (Fry, 2011). Without the existence of institutions or
952 individuals capable of wielding coercive authority, society would have been unable to regulate intergroup
953 violence, either by preventing it or utilizing it to advance the aims of the group. Because these societies

would have lacked a strong sense of group identity, which emerged with greater cultural complexity in the past 100 kya, the tit-for-tat revenge raiding common in recent human groups would have likely been absent. During this period of our species' evolution, the preconditions necessary to transition from simple raids to more complex and deadly forms of conflict, such as battles, would have also been absent. Developing more complex and high-risk types of conflict in humans requires solving the collective action problem in warfare, incentivizing participants to take greater risks, and coordinating members. It is difficult to imagine how these challenges could have been overcome without social structures that could mobilize, incentivize, and coordinate participants—social structure that were likely absent at the beginning of our species.

The social structures that facilitate war also enable the cooperation required for peacemaking and large-scale cooperation more generally. Thus, early in our species' history we would have lacked the ability to wage the total warfare found in hierarchal societies and that fully emerged in agricultural states, but we would have also been unable to create peace through sustained interdependent cooperative relationships between groups. When humans developed the cognitive and cultural capacities allowing them to solve challenging collective action problems, they would have both been able to wage more complex and deadly war and pursue peace using the same social and cognitive mechanisms that allow for total war (Kim & Kissel, 2018). An increase in war would have created an increased need for peace, thus "the elaboration of peacemaking goes hand in hand with the origin and development of war" (Kelly, 2000, p. 161). War and peace likely co-evolved from small, unorganized raids and periodic intergroup cooperation to intense, larger-scale strategic violence alongside the development of cultural technologies allowing sustained cooperation and trade, such as bond friendships, fictive kinship, ritualized trade, and rituals for peace. The development of increased social complexity enables both peace and war; thus, tribes have a greater capacity for peace and more intense warfare than bands, chiefdoms more than tribes, states more than

chiefdoms. As societies become capable of scaling conflict or peace up, the dynamics of war and peace change enabling total war and sustained peace.

8. WHY ISN'T PEACE MORE COMMON IN OTHER SPECIES

Chimpanzees usually avoid strange chimpanzees, but when they greatly outnumber strangers, they are more likely to attack and kill them. Bonobos, on the other hand, sometimes approach strange bonobos, sharing food, grooming, or mating with them, but they often do so in the context of high levels of physical aggression between groups. Neither bonobos, chimpanzees, nor any other mammal, has anything resembling the durable positive-sum harmonious relationships that characterize human groups. Why do humans have the ability for peace while other mammals lack it? The key components that enable peace include high potential benefits from intergroup interactions, the ability to anticipate the behavior of strangers and regulate the behavior of other group members, and the capacity to resolve conflicts and signal future cooperative intent of group members. Each of these provides a partial solution to the prisoner's dilemma that leads to costly intergroup conflict and in theory these capabilities could develop in other social mammals, including chimpanzees and bonobos. But peace doesn't develop in these other species because solving these challenges is significant. Humans were positioned to create peaceful cooperative intergroup relationships due to unusual aspects of our evolution that prepared us to uniquely benefit from interdependent intergroup relationships.

The potential benefits humans receive from intergroup interactions appear larger than for other social mammals. For most social mammals, the primary benefits include meeting potential reproductive partners and inferring information about groups for future transfers or interactions. Humans gain these potential benefits and many more due to our unique lifestyles, which obligately require high levels of interdependence. Hunter-gatherers, who characterize most of our species' history, typically engage in complementary foraging strategies where individuals target resources in consideration of the resources

1003 that others are pursuing (Kelly, 2013) and share food among a wider social group including family and
1004 other community members (Gurven & Jaeggi, 2015; Wood & Marlowe, 2013). At the same time, we
1005 obligately depend on sophisticated cumulative cultural technologies, including fire for cooking food, stone
1006 tools for butchering, and weapons for hunting, alongside cooperation in labor and parenting, all of which
1007 are hypothesized to date deep into the Pleistocene preceding the origins of *Homo sapiens* (Kaplan et al.,
1008 2009; Kramer, 2010; Wrangham, 2009).
1009
1010 The obligate food sharing, complementarity, and cultural technology seen in humans is in stark contrast
1011 to other social animals, who can generally satisfy their adult caloric and survival needs through non-
1012 cooperative, non-cultural individual or collective foraging behavior. Thus, by the birth of our species, early
1013 *Homo sapiens* was preadapted for intergroup interdependence because our very survival requires high levels
1014 of in-group interdependence. Once we began to expand our home ranges and rely on resources obtained
1015 from distant areas, we would have come into more frequent contact with outgroups; but unlike other
1016 species with low levels of interdependence, these early humans would have been able to obtain significant
1017 benefits from intergroup interactions due to the fact that we were already an interdependent species. It is
1018 a small step to go from relying on in-group members to access food, information, and materials necessary
1019 for survival, to obtaining these from outgroup members, especially during periods of scarcity. Because
1020 most non-human social mammals have drastically lower levels of interdependence within their groups
1021 than humans do, their potential benefits from intergroup interactions may not be sufficient for durable
1022 positive-sum relationships to develop.
1023
1024 Non-human animals also lack many of the psychological capacities that enable peace in humans,
1025 especially norm compliance and enforcement, which is critical for modifying the potential payoffs that
1026 individuals may receive from aggression. While the origins of our norm psychology continues to be
1027 debated, several theories posit that it extends to the birth of our species or perhaps earlier (Boehm, 2012b;

1028 R. Wrangham, 2019). Without the capacity to enforce the behavior of other group members, it is difficult
1029 to understand how other social mammals could avoid the prisoner's dilemma that leads to conflict when
1030 the potential benefits from aggression and cooperation are asymmetric.
1031
1032 While humans are unique among vertebrates for having peace, we are not the only species to have
1033 sustained cooperative and positive-sum intergroup relationships. While many species of ants have lethal
1034 intergroup violence that often exceeds the severity of human warfare (Moffett, 2011), several species of
1035 ants are *polydomic*, appearing to have relationships that meet the conditions of peace in which spatially
1036 distinct ant nests have non-aggressive mutual exchanges of workers, brood, and food between them (Ellis
1037 et al., 2017; Ellis & Robinson, 2016; Robinson, 2014). Unlike humans, they arrive at peace through
1038 fundamentally different mechanisms, avoiding the prisoner's dilemma that makes conflict so common in
1039 humans[6].
1040
1041 In evolutionary terms, success is ultimately measured in fitness—individuals who do better are those who
1042 pass on more copies of their genes. Warfare in humans can be a pathway for warriors to increase their
1043 fitness by having more children than they would otherwise or by receiving support that leads to improved
1044 offspring survival. In humans, some individuals may benefit more from war than others. The asymmetry
1045 in the potential benefits that group members receive from war creates a prisoner's dilemma in which
1046 individuals may be incentivized to aggress against outgroups, making peace difficult to obtain. Humans
1047 use cultural solutions to solve the prisoner's dilemma, enabling peace.
1048

[6] Many thanks to Elva Robinson for pointing me towards the literature on polydomous ants and her important insight that they avoid the PD that enables intergroup conflict in humans.

In contrast, ants achieve peace through an entirely different pathway unavailable to most animals. While each reproductively intact human can reproduce, giving rise to potential fitness differences, in ants, workers are unable to reproduce, and genes are only passed on through the success of their queen. In these conditions, the colony, not the individual is considered the reproductive unit (Hölldobler & Wilson, 1990). Thus, the interests of individual ants within the same society are aligned with each other: One ant cannot asymmetrically benefit through intergroup aggression compared to their other group members. If aggression or cooperation is the best strategy for an ant society, the payoffs apply symmetrically to all workers in that society. In effect, the prisoner's dilemma that makes peace so challenging in humans and other animals is avoided in ants. It is not clear what conditions in ants favor the development of intergroup cooperation, though polydomous ants in separate colonies tend to be closely related (Robinson, 2014). However, recent research suggests that cooperation between polydomous colonies is not due solely to their relatedness because polydomous colonies also have increased kin competition resulting from having more individuals in closer proximity competing for limited resources (Rodrigues et al., 2022). Understanding how ants can achieve the remarkable feat of durable, positive-sum, interdependent relationships will potentially provide new insights into the conditions that prevent and promote intergroup cooperation.

9. VARATION IN WAR AND PEACE ACROSS HUMAN SOCIETIES

The framework I have developed also provides insight into why war and peace vary so much across human societies and can resolve some of the conflicting evidence regarding intergroup relationships in small-scale societies. War among mobile hunter-gatherers is sometimes considered intractable (Helbling, 2006; Wrangham & Glowacki, 2012) (though see (Fry, 2007) for an alternative perspective). At the same time, hunter-gatherers tend to have less frequent conflicts and lower rates of death due to warfare than small-scale groups such as horticulturalists and pastoralists (Keeley, 1996; Wrangham et al., 2006). What explains these apparent discrepancies?

Mobile hunter-gatherers typically have fewer status distinctions, reduced reproductive skew and wealth inequality, and less developed social institutions to regulate behavior. The result of these is that the prisoner's dilemma is less acute among mobile hunter-gatherers because the potential benefits from offensive aggression are generally lower for participants than in societies with more complex social structures such as pastoralists. Lacking these social structures, it is also difficult for hunter-gatherers to regulate the behavior of would-be defectors and thus make peace. As a result, they are sometimes characterized as having ceaseless war, even though the actual intensity and severity of war is often lower than in other small-scale groups such as horticulturalists or pastoralists who have more significant social structures. Societies with more integrative and socially binding features such as age-sets or markers of strong in-group identity have a greater capacity to make peace, but these same features can be used to promote war.

Thus, evaluating how social and cultural factors shape payoffs to individuals is critical to understanding social variation in war and peace. It may be difficult or impossible to make peace when the payoffs for defection are high. At the same time, the social structures that are necessary for implementing peace can also exacerbate the conditions that lead to conflict by making it easier to mobilize individuals. The key factor is not that a subsistence strategy necessarily yields either war or peace, as is sometimes assumed for hunter-gatherers and pastoralists, but rather that social and cultural features constrain and influence behavior by shaping the payoffs associated with war and peace.

10. CONCLUSION

From the available evidence, it appears that intergroup cooperation would have developed by 300,000 years ago and likely been a selective feature of human evolution, favoring the propensity to identify and exploit opportunities for positive-sum intergroup interactions. The social structures required for peace, however, developed much more recently, likely within the past 100,000 years. Although this is a narrower time frame, it still provides ample opportunity for selection to favor the evolution of psychological traits that would facilitate conflict prevention and resolution, including increased tolerance, affiliation, social norm compliance, and reduced aggression.

The presence of material and social benefits to attackers, alongside the low risk of being killed or injured, can promote intergroup violence. Multiple lines of evidence also suggest that these payoffs may have been present for at least the past several hundred thousand years. Certainly, by the late Middle Pleistocene, we would expect that human groups would have had at least occasional lethal conflict, resulting either from disagreements that escalated or because unilateral aggression would have been beneficial to the aggressors. And this intermittent intergroup violence may have also been a selective factor in our species evolution within the past 100,000 years ago, just as intergroup cooperation would have been.

This evidence suggests that we should not consider ancestral interactions between human hunter-gatherer groups as one of "unremittent hostility" or "ceaseless war". Rather, we would expect that as soon as humans were able to have positive sum interactions, they would have sought out ways to do so. Generally tolerant interactions (ranging from avoidance to cooperation) would have been more common than violent conflict. The costs and benefits resulting from both violence and cooperation would have created selection pressures for each insofar as they resulted in differential fitness (Majolo, 2019). This may explain why it is so easy for humans to cooperate across group boundaries, and also why it is so easy for that cooperation to break down into conflict.

Despite the fact that humans everywhere have a spectrum of relationships ranging from peace to war, some scholars continue to stipulate that our early human hunting and gathering ancestors did not have lethal intergroup aggression. This view perpetuates the stereotype of hunter-gatherers as fundamentally different from other humans and advances a contemporary version of the noble savage. The alternative I argue for here is that our human hunting and gathering ancestors were like humans everywhere—they could identify the costs and benefits resulting from various behaviors and act strategically on them. They could identify and enforce norms that advanced their interests, including norms that favored aggression or peace. As a result, ancestral hunter-gatherers were likely to be motivated towards both cooperation *and* aggression across groups depending on the situation (Kissel & Kim, 2019; Majolo, 2019). Once intergroup conflict emerged, they would have struggled, just as contemporary groups do, to resolve the conflict and restore cooperation.

The traits and the technologies that allow people to mobilize, achieve collective action, cooperate across groups, and sanction spoilers to enable peace are the same traits that are used to wage war. Social identity, for example, is a mechanism that can promote intergroup conflict for the same reasons that it can facilitate peaceful interactions—by allowing generalized norms about outgroups and through holding other members of a group responsible for the behavior of each of their members. Social complexity and leadership can promote peace but are also associated with an increase in warfare intensity. Recognizing the potential costs and benefits of relationships and acting strategically to maximize them can lead to groups either setting aside long-held differences or engaging in unprovoked aggression. Thus, the better our species became at creating peace, the better we also became at waging war. The alternative to social mechanisms to create peace is confinement to a limited social world like that of bonobos or chimpanzees, in which each and every interaction with outgroups has to be negotiated individually—a world that leaves little certainty about future interactions and where truly positive sum long-term relationships are

impossible. It is also a world lacking the fluid exchange of ideas across group boundaries, where cumulative cultural evolution, the linchpin of our species' success, does not occur.

We have seen that intergroup cooperation is one step on the pathway to peace. But peace requires innate psychological capacities, including tolerance, social identity, the development and enforcement of norms, and the ability to identify the costs and benefits of actions and to strategically modify one's behavior accordingly. Peace also requires cultural traditions and social structures to prevent and resolve conflicts that emerge. Thus, while intergroup coalitionary aggression and intergroup cooperation may be evolved traits, peace is an invention. It is the solution to a specific problem—how to prevent and resolve conflicts, creating the conditions for sustained positive-sum interactions that cross group boundaries. If our society is to progress beyond the ironic logic of peace and war, it will require engineering social systems that can withstand the challenges of defectors and the potential payoffs from violence. It will require recognizing that humans are the product of our evolved psychological tendencies, which includes the propensity to easily form coalitions and divide the world into ingroups and outgroups—and sometimes to use violence strategically against others to benefit ourselves—but also includes the propensity to form cooperative intergroup relationships and treat strangers as friends.

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