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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 beginning at least 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 of 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 coevolving with increasing social complexity and agriculture (Fry, 2011). 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 toward 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, Connor, Fay, Melillo-Sweeting, & Dudzinski, 2022; Elliser, Volker, & Herzing, 2022), sustained positive-sum relationships that cross pronounced group boundaries are exceedingly rare among nonhuman animals 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, Langergraber, & Surbeck, 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, Samuni, Lucchesi, Deschner, & Surbeck, 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, Hohmann, Trumble, Fruth, & Jaeggi, 2022). Among nonhuman 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 nonexclusive 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 nonaggression, 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 complex 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 & 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 article. In section 2, I argue that peace is best understood as a solution to a cooperative dilemma such, 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 by arguing that our human ancestors were neither warlike nor 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 nonstate societies in the ethnographic record are isolation and subordination, neither of which is synonymous with peace.

First, groups without war are often 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 1,000 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 commonly 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 nonexistent levels of violence toward 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

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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’s (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 an ongoing state of interactions between members of different groups (whether kin group, clan, band, tribe, etc.), characterized by harmonious interactions where conflicts are generally resolved and are expected to be resolved without violence. A society may have peace with one group while having violent interactions with another group. This definition does not require the complete absence of aggression or violence in intergroup interactions, only that violence is rare, unexpected, and quickly resolved.

1.1.1. Cooperative relationships do not imply an absence of war

Intergroup cooperation is likely universal across human societies, including among societies with high rates of war and violence. While cooperation, including trade, may promote peace, the presence of cooperation alone is not evidence that war between groups is absent. This is an especially important point when examining the archaeological evidence of intergroup relationships. Cooperation, including trade and marriage, can occur in the context of broader intergroup hostilities or large power asymmetries, such as those in patron–client relationships where the weaker parties act in a context of intimidation (as the Semai appear to be). In cases of active hostilities between two populations, individual parties often continue to cooperate across group boundaries, exchanging information, materials, or goods. Thus, archaeological and ethnographic evidence of cooperation alone is not satisfactory for demonstrating the absence of war, even though intergroup cooperation can enable peace, and peace expands the potential for cooperation (Keohane, 2005).

2. Peace as a solution to a cooperative dilemma

2.1. The structure of decentralized war

Understanding how peace is achieved in small-scale decentralized societies requires first understanding how and why individuals participate in war in these same types of groups. Small-scale decentralized societies have a fundamentally different pattern of conflict than state societies with militaries (Wright, 1942). Counterintuitively, 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 without 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 noncoercive. 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 power (approximately eight attackers to one victim) with little evidence of chimpanzee attackers being seriously injured or killed (Wilson & Wrangham, 2003; Wilson et al., 2014). When there are casualties 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 to intergroup conflict in chimpanzees. As societies increase in sociopolitical complexity, they often adopt more structured forms of intergroup violence, such as battles (Dye, 2009, 2013; Glowacki, Wilson, &

Wrangham, 2020), which can greatly increase the mortality rate of attackers as well as 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, thus war often provides 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 subsistence) (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, Walker, Flinn, & Chagnon, 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 et al., 2009, for a potential counterexample).

Even in instances where intergroup violence is not socially endorsed, attackers still often 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.

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, Dietz, Witsenburg, & Zaal, 2012; Scheffran, Brzoska, Kominek, Link, & Schilling, 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 through 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

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 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 and asymmetries in the number of attackers and defenders. 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 the possibility of receiving private benefits, but simultaneously costly for other members of the group.

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 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 out-groups), 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 & Gross, 2019; Dreu et al., 2016; 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 (Fig. 1), as other members of the attacked group seek revenge. Thus peace requires coordinating the interests of all group members for nonaggression 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 (Yair & Miodownik, 2016). While women in small-scale societies rarely participate in violence themselves, they often have an important role in encouraging men toward 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 toward cooperation but must also be tolerant and resilient against instances of real or perceived defection.

2.5. Relevance to centralized (state) warfare

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

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

Despite the differences between state and decentralized war, there are important similarities in the logic of war and peace.

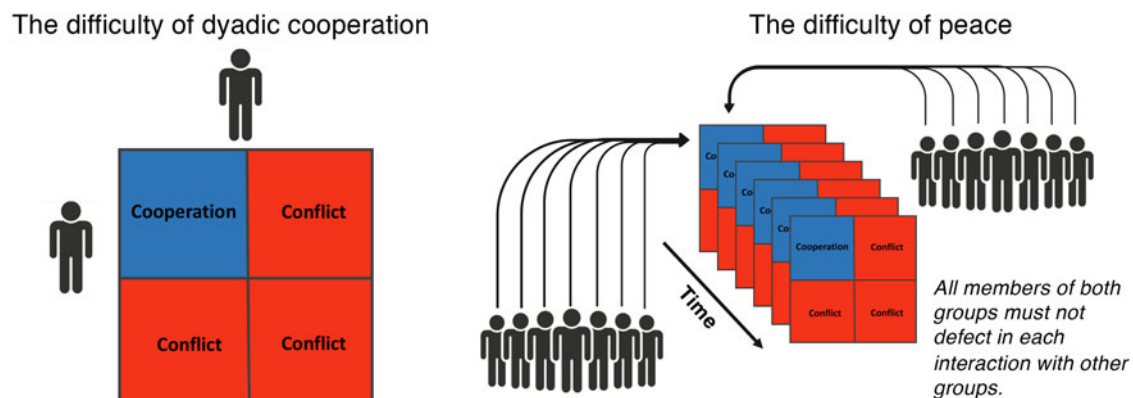


Figure 1. Peace as a prisoner’s dilemma. Intergroup conflict can be studied as an iterated prisoner’s dilemma. The key challenge to peace is developing payoff systems that favor cooperation by member of both groups that are resilient against real or perceived defection.

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 cannot 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 toward peace, and to assume that the other side has cooperative nonaggressive intentions may leave them open for attack (Powell, 2006; Walter, 2009).

3. Prerequisites 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 social mechanisms through which interactions between members of separate groups are governed by norms that stipulate nonaggression. At the same time, when conflicts do emerge, societies require the ability 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, nonaggressive interactions that cross group boundaries. While humans clearly have this capacity, many social species lack this ability. Chimpanzees, for example, rarely have tolerant intercommunity 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 group-living species, in which groups generally avoid each other). 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 nonhuman 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 times of need, such as water, game lands, or grazing (Cronk & Aktipis, 2021; Glowacki, 2020; Kelly, 2013a, 2013b; Pisor & Jones, 2021). A potentially more important form of interdependence would have developed when groups began to rely on nonlocal 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, Martin, & Jaeggi, 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 afterward (Garfield, von Rueden, & Hagen, 2019). Highly interdependent regions often developed ritualized trade and exchange systems to maintain peaceful relationships, such as the White Deerskin dance (Goldschmidt & Driver, 1940), the potlatch (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 out-groups 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 out-groups 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 other groups. But how do we 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 does the same.

3.3.1. Norms reduce uncertainty in intergroup relationships

The vast scale at which humans cooperate both within and between groups 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 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 nonaggression) 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 out-group (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, warmth, or hostility). In such cases, each interaction is negotiated spontaneously and tentatively, as in other 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 out-group. 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 as 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, Lavi, Reckin, Cristóbal-Azkarate, & Ellis-Davies, 2018; McElreath, Boyd, & Richerson, 2003; Pope-Caldwell et al., 2022). Once norms governing relationships with out-groups 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 also anticipate that the interactions will be nonaggressive. 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 a group and to enforce norms, the conditions were in place for the development of norms about how to treat out-groups.

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 out-group members may stipulate non-aggression, which promotes peace, or they may endorse violence toward out-group members which drives warfare. In small-scale traditional societies, violence toward out-groups was frequently tolerated or even rewarded through cultural incentives (Otterbein, 1989). Multiple studies have found that the presence of norms for violence is 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 toward nonaggression 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 nonaggression toward out-groups 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 invest a group of coevals with authority over their members (Garfield et al., 2023; 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 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 toward 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 out-group members will be misinterpreted as having aggressive intent, triggering intergroup conflict (Fig. 2).

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)

The key challenge after intergroup conflict is to prevent members of the aggrieved group from taking revenge. This often requires restitution to the aggrieved party for the harm they have suffered

(see Table 1). This may involve in-kind exchanges, such as replacing stolen livestock with other livestock or the utilization of different currencies, such as providing the aggrieved group with a person from the offender’s group (usually a young woman). Because blame is often ascribed to the group rather than the individual, restitution frequently comes from members of the perpetrator’s group, rather than from the perpetrators themselves.

Not only does the offending group have to offer restitution, but the aggrieved group must accept it as satisfactory. This negotiation provides another arena for conflict between groups as they determine an adequate level of restitution that satisfies both groups. For example, among the Kalinga, “kindreds [of the victim] are rarely satisfied with simply being paid off, and often retaliate by a counter-killing” (Dozier, 1967, p. 93). Reaching satisfactory compensation can be difficult, especially when tensions between groups are high.

At the same time, the offending group needs to signal cooperative intent, for example, that future interactions are likely to be positive and that the offender’s actions do not represent a new norm on the part of the offender’s group (Roscoe, 2013). The need to signal cooperative intent is why peacemaking after a violent conflict often requires that the offending group execute one of their own group members. For example, among the Curripaco “lineage members decided to execute ritually their kinsman who had killed, rather than provoke a spate of tit-for-tat revenge killings” (Valentine, 2008, p. 36). While among the Erbores of southwest Ethiopia, one elder reported “We brought about peace by allowing two Erbores...to be killed by our enemies. I, myself, have handed over one of our sons to be killed” (Sullivan, 2008, p. 16). Drastic actions such as the execution of the offender can signal to the aggrieved group that future interactions are likely to be positive.

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

3.5. Third-party mediators and leadership

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

Leadership facilitates peace because individuals who wield asymmetric power can prevent war or establish peace using their influence over others (such leaders can also use their



Figure 2. Examples of peacemaking rituals: (A) Andaman Islands: Peacemaking 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).

influence to motivate warfare) (Garfield, Syme, & Hagen, 2020). As a result, peace efforts in small-scale societies are frequently led by prominent individuals who motivate in-group members to maintain peace, sanction offenders, and negotiate with out-group members (Fry, 2007; Fry et al., 2021; Glowacki & Gonc, 2013). Some societies institutionalized the role of peacemaker into a position such as a peace chief or peace leader (Bacdayan, 1969; Goldschmidt, 1994; Moore, 1990), who “appeared at the scene of battle... and attempted to induce disputants to come to amicable agreement” (Goldschmidt, 1951, p. 326). However, these kinds of formal peace leaders occur more frequently in societies with significant social stratification such as the Kalinga and Cheyenne. The absence of prominent leadership who can negotiate for peace is a key impediment to the development of peace in decentralized societies.

Third parties have an important role in restoring relationships after conflict in small-scale societies, whether within or between groups (Fitouchi & Singh, 2023; 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 more likely to consist of government representatives or nongovernmental organizations (NGOs) (Box 1). 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,

2023; 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 Wanggular to settle quarrels” (Ploeg, 1979, pp. 170–171).

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, nonparticipants, 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 toward 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

Table 1. Common conflict resolution mechanisms

Symbolic ceremony	(1) <i>Sama Dialut</i> – A coconut-splitting ritual ceremony involving prayer that culminates in enemy parties resuming speech with each other (Sather, 2003). (2) <i>Rotumans</i> – 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). (3) <i>Ojibway</i> – 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). (4) <i>Andaman Islanders</i> – Dance ceremony where the “forgiving party” dances into camp making threatening gestures toward the other group. Afterward both parties exchange weapons (Radcliffe-Brown, 1922).
Wergild (compensation for harm done)	(1) <i>Santa Cruz Islanders</i> – An exchange of a pig to compensate for damage (Davenport, 1969). (2) <i>Curripaco</i> – Exchange of a woman or future child to resolve conflict over land (Valentine, 2008). (3) <i>Tlingit</i> – Exchange of blankets and an enslaved person, to compensate for the loss of a life (Jones, 1914). (4) <i>Murngin</i> – Sending food and tobacco to the injured group; every member of the clan must partake (Warner, 1931).
Mock or ritualized conflict	(1) <i>Yukpa</i> – Use of corncob arrows (Halbmayer, 2001). (2) <i>Northwest Amazon</i> – Enactment of warfare before gifting (Chernela, 2008). (3) <i>Ona – Jelj</i> : Shooting arrows without arrowheads between enemy parties (Bridges, 1949). (4) <i>Murngin</i> – Ritualized spear-throwing between groups, especially toward the aggressor (Warner, 1931).
In-group sanctions	(1) <i>Curripaco</i> – Killing those who had killed previously (Valentine, 2008). (2) <i>Daasanach</i> – Those who disturbed the peace had their animals killed as punishment (Houtteman, 2010). (3) <i>Kapauku</i> – Responsible party has to pay or be given to the enemy to be killed (Pospisil, 1994).

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 nongovernmental organization hosts a multiday intertribal 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 nine women and two 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 cograzing.

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.

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 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, Yost, & Peeke, 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 hot-heads... 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 intertribal 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" (Knauff, 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 schemata...they were able to imagine and to seek a new world, one without the constant fear of violent death. In a matter of months, the Upriver band abandoned the pattern of internal and external raiding that had persisted for generations" (Robarchek & Robarchek, 1998, p. 157).

States also provide access to valuable new goods. For the Kutchin, "why did the two peoples stop fighting...? It is likely, that the natives... saw trading and trapping as more profitable than fighting" (Slobodin, 1960, p. 90). For the Enga, peace followed shortly after contact, when the Australians "gave beads, salt, steel axes – everyone wanted it so they all followed the Kiap [Australians] and stopped fighting. *We stopped fighting because we did not want to lose the source of these things*" (Podolefsky, 1984, p. 75). In the Arctic "a desire for the newly arriving Western goods replaced the raiding parties with trading parties and hostilities... transformed into different forms of competition in the new economic situation" (Funk, 2010, p. 557). Finally, among the Arbore of Ethiopia, "[new] developments also can be advantageous for the peace process, e.g., when new fashion items substitute for killing emblems, and when guns and bullets are sold on a large scale by young Arbore in order to buy mobile phones and pay their telephone costs" (Gabbert, 2012, p. 244).

State institutions commonly allowed actors who were traditionally excluded by indigenous institutions, such as women and youths, to participate in the peace process (Fig. 3). For example, during a 2006 peace meeting in the Omo Valley, when women spoke to the groups assembled one reported "we are sick and tired of the attacks on us and our children... men solve their problem and later on the problem returns. We ladies are arguing... *they should give us the chance* [to make peace]"



Figure 3. Peacemaking in contemporary societies. Women and youths are typically excluded from customary forms of peacemaking in many societies. Contemporary peacemaking initiatives actively work to involve all sections of communities. At an intertribal peace meeting in the Omo Valley: (A) Nyangatom women speak about their desires for peace and (B) male youths indicate their desire for peace. Photos courtesy of Sylwia Pecio.

(Sullivan, 2008, p. 20). In Papua New Guinea, in the middle of a tribal battle “women walked into the middle of a battlefield between opposing sides.... They offered the men payments of foodstuff, money, cigarettes and soft drinks to lay down their arms. The women were members of a woman’s club... associated with ‘governmental law’ and business, which were then seen as impartial yet powerful forces” (Henry, 2005, p. 434).

6. When intergroup cooperation and peace emerged

Despite the uncertainty regarding when war evolved in our prehuman ancestors, we can make tentative 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 toward 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, if either 2023, 2021; regardless, the fact that bonobos exhibit high levels of tolerance toward out-group 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).

Paleoarchaeology provides clues as to when repeated cooperative intergroup interactions first became important in the human lineage, particularly through long-distance exchange networks. While the paleoarchaeological record reflects preservation bias and estimates are likely to be revised when new evidence emerges, it at least provides a baseline to date the development of cooperative relationships between groups (Tryon & Faith, 2013). Prior to 700,000 years ago, there is little evidence that our hominin ancestors engaged in or would have needed to engage in intergroup cooperation and avoidance of other groups was probably a common strategy due to the risk of being killed or injured in intergroup interactions. The fact that early *Homo*, unlike chimpanzees or bonobos, used sophisticated tools such as hand

axes (Ambrose, 2001), would have made intergroup interactions more perilous than in other primates, as a single individual from another group could inflict potentially lethal violence (Johnson & MacKay, 2015).

The patterns of intergroup interactions began to change around 615–499,000 years ago, when early humans began to acquire lithic materials from more distant sources (Potts et al., 2018) with some evidence of occasional long-distance transport (Clark et al., 1984; Féblot-Augustins, 1990). The increased reliance on nonlocal materials suggests that these early humans were expanding their ranges, becoming more likely to encounter and interact with other groups and creating benefits to sharing information about techniques and locations of materials.

6.1. Intergroup cooperation in the late Middle Pleistocene

Dramatic changes in early human behavior began around 300,000 years ago. Some of the earliest reliable evidence of regular long-distance transport of stone materials appears between 295,000 and 320,000 years ago, with raw stone materials being transported more than 50 km in straight line distance (walking distance would have been much greater), exceeding the typical home range of many recent hunter–gatherers (Brooks et al., 2018). Similarly, at the Sibilo School Road Site in Kenya, there is strong evidence for long-distance transport of stone materials dating back to more than 200,000 years ago from sources located 25, 144, and 166 km away. Surprisingly, most of the transported obsidian is from the farthest source at 166 km away, not the closest source at 25 km away (Blegen, 2017). The distance these materials were transported is far greater than the estimated home ranges of forager bands and is more consistent with the exchange networks for modern hunter–gatherers, which could involve scores of people across hundreds of miles (Ambrose, 2012; Bird, Bird, Codding, & Zeanah, 2019; Yellen & Harpending, 1972). This kind of resource movement suggests “intensive, perhaps even obligate intergroup exchange rather than down-the-line-exchange” such as the exchanges that characterize the Kula cycle (Ambrose, 2012, p. 65). Around the same time, the use of ochre was increasing, and by 300,000 years ago it was in regular use in some regions, with much of it also being transported long distances, at a minimum of 38 km but potentially up to 170 km away (Watts, Chazan, & Wilkins, 2016).

Increases in intergroup exchange around 300,000 years ago are paralleled by skeletal changes in the human lineage toward increasing gracility. Skeletal and cranial gracility is often used as a proxy for reduced reactive aggression (Chirchir, 2021; Wrangham, 2019). Reduced reactive aggression allows for increased out-group tolerance, enabling affiliation with strangers. The earliest evidence for gracility among human ancestors comes from archaic *Homo sapiens* around 320,000 years ago (Wrangham, 2019), around the same time as the emergence of long-distance stone transport, suggesting that humans around this period were becoming less reactively aggressive while simultaneously increasingly relying on intergroup trade.

The development of long-distance transportation networks, increased selectiveness of stone tool materials, bodily adornment with ochre, and reduced reactive aggression all around 300,000 years ago or earlier suggest strongly that the early human social environment was changing dramatically. These changes would have both enabled and promoted positive intergroup interactions, leading groups of early humans to seek out interaction with other groups they could possibly benefit from (Wilson & Glowacki, 2017). The payoffs from cooperation are significant enough that beginning around 300,000 years ago, the ability to identify cooperative possibilities across intergroup boundaries would potentially have been a selective force favoring increased prosociality (Hames, 2019; Wilson, 2013). Thus, by 300,000 years ago at the latest, humans would have been capable of intergroup tolerance, relationships across group boundaries would have at least been periodically cooperative, and these relationships would have provided access to valuable resources including stone for making tools and ochre (Pisor & Ross, 2021).⁵

Peace, however, requires more than periodic cooperative intergroup exchange. It requires social structures to develop and enforce group-based norms, and prevent and resolve conflicts. Direct and circumstantial evidence in support of these prior to the last 100,000 years ago is lacking. Given what we can reasonably infer about group size and social complexity this deep in the Pleistocene, they were highly unlikely to be present. Societies at this time were likely to be small and unstratified, with few means to regulate and enforce norms against intergroup aggression and with little evidence of the types of specialization that would promote intergroup interdependence. Without these social structures in place to regulate intergroup interactions, the increased frequency of intergroup interactions during this period (300 to 100 kya) increases the likelihood that some intergroup disputes would result in violence. Without the ability to prevent and resolve conflicts, it would have been extremely difficult to turn periodic cooperative intergroup interactions into the stable harmonious relationships that characterize peace.

6.2. The potential for peace in the Late Pleistocene

Our more recent evolutionary history provides strong evidence that humans were developing material and social technologies that would have made peace more likely within the past 100,000 years. The development of new lithic techniques and specialized hunting, as well as the regular exchange of stone, shell, and ochre all during the last 100 kya (Foley & Lahr, 2003; McBrearty & Brooks, 2000) created the conditions for high levels of interdependence, which is a crucial means of incentivizing intergroup cooperation and preventing conflict. Between 75 and 100 kya there appears to have been a large increase in the development of complex material technologies, status symbols such

as shell beads, and symbolic behaviors (Bouzougar et al., 2007; Roberts & Stewart, 2018; Shipton et al., 2018). Access to the materials and knowledge of how to produce these items would have increased the incentives for intergroup cooperation to obtain these materials and the cultural knowledge of their manufacture and meaning. The development of decorative and status items indicates that group identity and social structures were becoming important, which enables the capacity for group-enforced norms and informal leadership, both of which would have facilitated the emergence of peace.

Rather than intergroup relationships being mostly local, evidence of extremely widespread trade emerges beginning 50,000 years ago when humans in East Africa began creating beads from ostrich eggshells (Miller & Wang, 2022). Not only were ostrich eggshell beads traded, but also a comprehensive study mapping the spread of bead patterns across eastern and southern Africa found that beads were exchanged over an area of 3,000 kilometers connecting both eastern and southern Africa (Fig. 4) lasting from 50–30,000 kya (Miller & Wang, 2022). Even after this pan-African trade broke down, regional trade within eastern and southern Africa over vast distances persisted until present times. Wide social networks like the ostrich eggshell trade are consistent with ethnographically recent hunter-gatherers who also were embedded in extensive exchange networks spanning hundreds of miles (Bird et al., 2019; Boyd & Richerson, 2022) (Fig. 4).

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 by 100,000 years ago, when evidence of large-scale trade, cooperation, and increasing sociopolitical complexity emerges (Boyd & Richerson, 2022; Miller & Wang, 2022; Singh & Glowacki, 2022), though regular intergroup cooperation likely dates back 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.

In addition to intergroup cooperation, lethal intergroup conflict would have occurred at least intermittently during this period. 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). Boehm (2013), for example, 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 frequency and importance of war during the Late Pleistocene is uncertain but it would have had the potential to become intense. 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

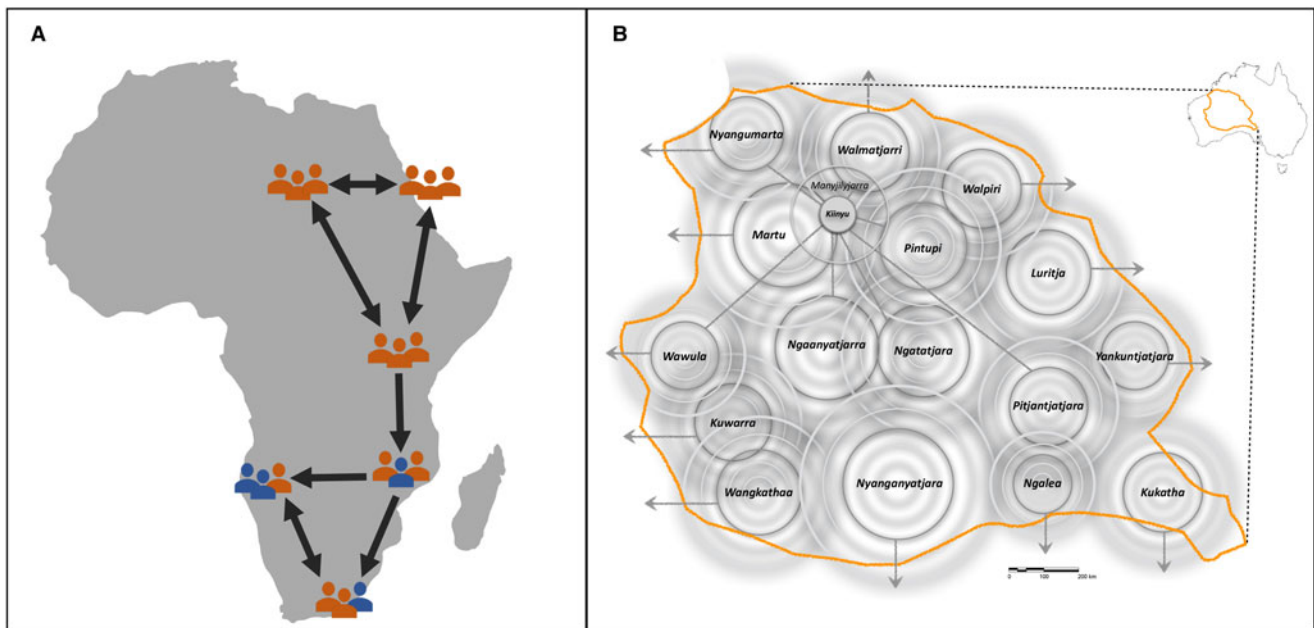


Figure 4. Long-distance trade and networks. (A) Long-distance trade networks of ostrich eggshell beads connected eastern and southern Africa from 50 to 30 kya. Reconstructed from Figure 4c in Miller and Wang (2022). (B) Hunter-gatherer social organization in Western Australia where individuals are embedded 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.

intergroup cooperation, lethal intergroup conflict would have been present during this period and likely had fitness consequences for aggressors..

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 *H. 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. Thus, while intergroup cooperation occurred and may have been a selective force for increased prosociality during this period, it was likely accompanied by at least intermittent intergroup conflict. Intergroup conflicts would have been opportunistic, occasional, and low intensity, with one or two victims, as opposed to the intense tit-for-tat raids seen among many contemporary small-scale societies. Beginning sometime between 100 and 80 kya, or slightly earlier, humans developed the social structures and cultural technologies to facilitate high levels of interdependence, creating greater benefits to cooperation, and to regulate conflict through norms that prohibit aggression and can be enforced through sanctions. These social structures would have created the conditions for societies to achieve peace, but also increased the potential severity of conflict through creating group-

based identities, norms that reward aggression, and enabled the organization of individuals for violence. Thus, from 100,000 years ago or so until the rise of hierarchical centralized societies, intergroup relationships likely consisted of both war and peace just as the more recent ethnographic record reflects.

7. The coevolution of peace and intergroup conflict

I have argued that the form of intergroup violence our early human ancestors would have been most likely to engage in is the raid, where a small group of individuals attempt to attack and kill members of other groups at low risk to themselves (Wrangham, 1999). Similar patterns are found in chimpanzees, wolves, and some other primate species including spider monkeys. Raiding parties would have been initiated by a small group of individuals acting in their own self-interest with little regard for the group's welfare. Raids themselves would have had lacked significant coordination, structure, or complexity besides utilizing the tactics of surprise and stealth. At the same time, human societies would have lacked internal social structures or differences in coercive authority within age and sex groups, approximating the social structure of more recent nomadic foraging groups (Fry, 2011). Without the existence of institutions or individuals capable of wielding coercive authority, society would have been unable to regulate intergroup 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 hierarchical 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 coevolved 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 is peace not more common in other species

Chimpanzees usually avoid outgroup chimpanzees, but when they greatly outnumber strangers, they are more likely to attack and kill them. Bonobos, on the contrary, sometimes approach outgroup 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 does not 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 that others are pursuing (Kelly, 2013a, 2013b) and share food among a wider social group including family and other community members (Gurven & Jaeggi, 2015; Wood & Marlowe, 2013). Indeed, food sharing is hypothesized to predate the origins of our genus (2023). At the same time, we obligately depend on sophisticated cumulative cultural technologies, including fire for cooking food, stone tools for butchering, and weapons for hunting, alongside cooperation in labor and parenting, all of which are hypothesized to date deep into the Pleistocene preceding the origins of *H. sapiens* (Kaplan, Hooper, & Gurven, 2009; Kramer, 2010; Wrangham, 2009).

The obligate food sharing, complementarity, and cultural technology seen in humans is in stark contrast to other social animals, which can generally satisfy their adult caloric and survival needs through noncooperative, noncultural individual or collective foraging behavior. Thus, by the birth of our species, early *H. sapiens* was preadapted for intergroup interdependence because our very survival requires high levels of in-group interdependence. Once we began to expand our home ranges and rely on resources obtained from distant areas, we would have come into more frequent contact with out-groups; but unlike other species with low levels of interdependence, these early humans would have been able to obtain significant benefits from intergroup interactions due to the fact that we were already an interdependent species. It is a small step from relying on in-group members to access food, information, and the materials necessary for survival, to obtaining these from out-group members, especially during periods of scarcity. Because most nonhuman social mammals have drastically lower levels of interdependence within their groups than humans do, their potential benefits from intergroup interactions may not be sufficient for durable positive-sum relationships to develop.

Nonhuman animals also lack many of the psychological capacities that enable peace in humans, especially norm compliance and enforcement, which is critical for modifying the potential payoffs that individuals may receive from aggression. While the origins of our norm psychology continues to be debated, several theories posit that it extends to the birth of our species or perhaps earlier (Boehm, 2012b; Wrangham, 2019). Without the capacity to enforce the behavior of other group members, it is difficult to understand how other social mammals could avoid the prisoner's dilemma that leads to conflict when the potential benefits from aggression and cooperation are asymmetric.

While humans are unusual among vertebrates for having peace, we are not the only species to have sustained cooperative and positive-sum intergroup relationships. While many species of ants have lethal intergroup violence that often exceeds the severity of human warfare (Moffett, 2011), several species of ants are *polydomic*, appearing to have relationships that meet the conditions of peace in which spatially distinct ant nests have nonaggressive mutual exchanges of workers, brood, and food between them (Ellis, Procter, Buckham-Bonnett, & Robinson, 2017; Ellis & Robinson, 2016; Robinson, 2014). Unlike humans, they arrive at peace through fundamentally different mechanisms, avoiding the prisoner's dilemma that makes conflict so common in humans.⁶

In evolutionary terms, success is ultimately measured in fitness – individuals who do better are those who pass on more copies of their genes. Warfare in humans can be a pathway for warriors to increase their fitness by having more children than they would

otherwise or by receiving support that leads to improved offspring survival. In humans, some individuals may benefit more from war than others. The asymmetry in the potential benefits that group members receive from war creates a prisoner's dilemma in which individuals may be incentivized to aggress against out-groups, making peace difficult to obtain. Humans use cultural solutions to solve the prisoner's dilemma, enabling peace.

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. Under 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 highly 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, Barker, & Robinson, 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. Variation 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 other small-scale groups such as horticulturalists and pastoralists (Keeley, 1996; Wrangham, Wilson, & Muller, 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. 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. 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 interactions between ancestral human 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 toward both cooperation

and aggression 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 out-groups 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 out-groups 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 in-groups and out-groups – and sometimes to use violence strategically against others to benefit ourselves – but it also includes the propensity to form cooperative intergroup relationships and treat strangers as friends.

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Notes

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 nonraiders 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.
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.
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.
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.
5. Thanks to Anne Pisor for suggesting that these might have also included long-distance ties between members of the same group.
6. Many thanks to Elva Robinson for pointing me toward the literature on polydomous ants and her important insight that they avoid the prisoner's dilemma that enables intergroup conflict in humans.

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Open Peer Commentary

On peace and its logic

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Abstract

Glowacki argues that the human capacity for peace emerged 100,000 years ago, and that the logic of peace is such that the traits and technologies that enable peace are the same that are used to wage war. In my commentary I raise some concerns about these points as well as about Glowacki's understanding of peace.

Glowacki understands peace as an ongoing state of harmonious interactions between social groups, with little or no violence, and where conflicts are expected to be resolved nonviolently (target article, sect. 1.1, para. 5). Two points he sets out to defend are: (1) peace, so understood, emerged approximately 100,000 years ago, and (2) the logic of peace is such that the “traits and the technologies that...enable peace are the same traits that are used to wage war” (target article, sect. 10, para. 5). In what follows I raise a few questions and concerns about Glowacki's understanding of peace and these two points.

Among prerequisites for peace Glowacki lists: The capacity to tolerate strangers, the motivation to interact with other social groups, the psychological and social structures necessary to develop, adhere to, and enforce norms regulating the intergroup behaviors of individuals (target article, sect. 3). He adds that regular intergroup cooperation, which “likely back dates to at least several hundred thousand years ago,” is insufficient; there must also be “high levels of interdependence” (target article, sect. 6.2, para 3). This last point seems questionable. *Prima facie*, intergroup peace is compatible with a wide range of degrees of interaction and interdependence. Why, for example, would not the strong desires of two groups not to be attacked by the other, to have their territories respected, and the like, at least sometimes motivate the implementation of group-enforcing norms capable of ensuring little or no intergroup violence – even if the degree of interaction and interdependence is not especially high (e.g., because that is how the groups want it)? Arguably, any adequate definition of peace should accommodate cases of this sort.

The requirement for peace at the heart of Glowacki's argument that peace emerged 100,000 years ago concerns group norms. Before that time societies “were likely to be small and unstratified, with few means to regulate and enforce norms against intergroup aggression” (target article, sect. 6.1, para. 4). Then around 100,000 years ago peace was facilitated by an increased emphasis on group identity, which was itself accelerated by a focus on material status symbols and symbolic behavior (target article, sect. 6.2, para. 1). While it is plausible that these developments led to more sophisticated forms of peacemaking, rather than maintaining that peace came into existence then, I believe a more accurate account would


have it that peace's emergence was a longer and more gradual process, lacking any sharp boundary. Learned behavioral norms, after all, are as old as culture itself. And because our capacity to sanction *within*-group violations of norms (cheating, theft, etc.) is much older than 100,000 years, it is hard to see why that capacity would not also be applicable across group boundaries earlier too. That raids have sometimes been difficult to control does not indicate a general inability to do so, since advanced contemporary societies also often fail to prevent segments of their populations from undermining peace. Regarding Glowacki's claims about group identity, the phenomena he points to also seem like just one step in a longer process. For much longer than 100,000 years humans have conceptualized groups and subgroups at various levels of social organization, with an ability to distinguish members from nonmembers (in-group/out-group). Distinguishing hunters from nonhunters, skilled toolmakers from the unskilled, and so on, depends on such an ability which, once possessed, would almost certainly also apply to humans outside of one's broad social group (e.g., band). If status is tightly related to group identity, as Glowacki suggests, it should be noted that there can be status without status symbols, and status symbols with primary functions unrelated to status (having the best-crafted tools and weapons, the most desirable places of shelter, etc.), which suggests that status too would have been operative earlier.

Turning finally to Glowacki's remarks on the logic of peace and war, on how our capacity for peace enabled us to wage more sophisticated and brutal forms of war, this is true as far as it goes. Of course, if what was said above about this being a long and gradual process is correct, that will apply here as well. On the whole, Glowacki's point appears to be a special case of the truism that technology (knowledge, skills, etc.) can be used for both good and evil. While his use of the word "logic" suggests a necessary connection of some kind between the concepts of peace and war, all that can be inferred from what he says, I believe, is that, at times in our past, *among* the traits and technologies that enabled peace are *some* traits that could also be employed to wage war. This means that in principle there could be features of peacemaking that make war less likely, or even prevent it. Glowacki appears to accept this, as he ends his article by holding out the possibility that humans might learn to counteract their tendency to wage war by "engineering social systems that can withstand the challenges of defectors and the potential payoffs from violence" (target article, sect. 10, para. 6). That means that although it will be difficult, and success is far from certain, there is nothing in the logic of peace and war barring humans from discovering how to end war.

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Evolution, culture, and the possibility of peace

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Abstract

Glowacki's work meshes well with our view of human nature as having evolved to use culture to improve survival and reproduction. Peace is a cultural achievement, requiring advances in social organization and control, including leaders who can implement policies to benefit the group, third-party mediation, and intergroup cooperation. Cultural advances shift intergroup interactions from negative-sum (war) to positive-sum (trade).

Glowacki's fascinating and informative article contends that intergroup peace is a historical achievement that is largely unmatched among other species. While some intergroup cooperation is found now and then in a few other species, it is extremely rare, and even observations of the few species that occasionally exhibit it (such as bonobos) generally reveal more intergroup violence than intergroup cooperation. Violence, from petty raids to ongoing warfare, has been common throughout human prehistory and history, but peace has also been achieved, enabling positive-sum intergroup cooperation (such as trade) by which both groups benefit. Progressively stronger and more complex social structures increased both war and peace. The two developments may not have been independent, because the greater lethality of war made peace all the more desirable.

All this resonates with our own thinking. We have sought to understand the human mind as tailored by nature and evolution to facilitate culture, as a highly potent strategy to improve survival and reproduction, which we call cultural animal theory (Baumeister, 2005; Baumeister & Bushman, 2021). Elaborating on why culture is such a successful strategy for improving survival and reproduction has become an important focus for us (see Baumeister & Bushman, 2023). As Glowacki says, both war and peace can benefit individuals in terms of reproductive success. War can protect and even acquire resources, especially among agricultural societies, whereas peace can spare lives.

Glowacki focuses on hunters and gatherers, which made up most of human history and prehistory. Among those, he says, war was not broadly beneficial for groups – but peace remained elusive because of individual acts of aggression and retaliation. He points out that many seemingly peaceful groups were merely "warless," either because their isolated territory lacked neighbors to fight, or because they had powerful neighbors whom it would have been futile and self-destructive to provoke. In other groups, however, endless small-scale raiding, in retaliatory cycles, with a steady stream of injuries and deaths, was the norm.

Glowacki says that peace requires advanced psychological capabilities to interact with other groups in a tolerant, nonaggressive fashion. Crucially, he adds, most social species lack this capability. This fits our cultural animal theory: Evolution gradually installed in the human mind traits that would make possible cultural advances that are impossible for other animals, even social animals. We speculate that the capacity for such mutually beneficial interactions with out-groups was not directly evolved but

rather emerged from the traits that made cultural life in general possible. Members of a group could agree, and especially leaders might see, that intergroup cooperation would be preferable to endless retaliatory warfare.

True peace is thus an invention and an achievement. That it is a group *cultural* achievement is also likely, given Glowacki's evidence that individuals can initiate raids and warfare, and indeed that usually in simple societies conflict is initiated by individuals. Most individuals and the group as a whole would benefit from peace, but individual men benefit from war, if only to redeem respect after being mocked by their group's female members for lacking courage and initiative.

Crucially, therefore, peace must be achieved by collective agreement. That includes pressuring or punishing individuals who might take it on themselves to initiate violent intergroup contact.

Warfare benefits from social organization and hierarchy, so we had assumed that the egalitarian ethos of hunter-gatherer groups would minimize war – or at least that temporary command hierarchies would emerge to prepare for battle. Glowacki provides compelling evidence that our assumption was wrong: Much aggression at that level is initiated by individuals (often persuading a couple buddies to join in a fairly safe raid on another group). Hence, he says, the emergence of hierarchy not only makes for more effective warfare but it also helps make peace possible. Authority figures can prohibit young warriors from making trouble, something that would have been impossible among the egalitarian hunter-gatherers.

Another factor promoting peace is third-party mediators. The basic structure of social interaction is dyadic, and indeed many interactions are defined by complementary pairs of roles (e.g., teacher-student, physician-patient, buyer-seller). Among cultural animals, however, there is often a third role in many interactions – someone such as a referee who represents the overarching cultural perspective. Animals play and compete but only humans have referees. The game is played between two teams, but the referee enforces the abstract rules from the culture. Animals fight and steal but only humans have police, judges, and other impartial overseers who act as referees. In intergroup conflict, a third-party mediator can help move things along toward peace.

Thus, the desirable state of intergroup peace is dependent on cultural advances, such as hierarchical leadership and third-party mediation.

We also appreciate his point that incentives for peace go beyond ending the destructive impact of war on people and property. In surveying the research on evil and violence, Baumeister (1996) observed that it is typically negative-sum, insofar as the perpetrator gains less than the victim loses. Ent, Sjästad, Baumeister, and von Hippel (2020) extended this to show that prosocial acts of helping are typically positive-sum, in that the recipient benefits more than the cost to the helper. The idea that intergroup trade is better than war (rediscovered in the modern world after World War II) provides a potentially powerful incentive to support peace. Trade is a form of cooperation. Both parties wish to make the trade – because they are better off having done so. Works on economic history frequently confirm the benefits of trade (Acemoglu & Robinson, 2012; Bernstein, 2004), as well as the costliness of even successful war.

Technological advances and increasing populations have made modern warfare ever more lethal, which is a sad commentary on the march of human history. To think that the progress of civilization has also enabled ever greater peace is a reassuring counterpoint.

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Economic games for the study of peace

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Abstract

Economic games provide models of real-world contexts in which researchers can probe dispositional and structural determinants of intergroup relations. Most intergroup games focus on determinants of aggression between groups and constrain the possibilities for peace. However, paradigms such as the intergroup parochial and universal cooperation game allow for peaceful intergroup relations and can be adapted for the study of peace.

In the target article, Glowacki draws on ethnographic studies to identify potential determinants of peaceful intergroup interactions. Although such studies provide rich descriptions with high external validity, they are less suited to causal inferences about the internal (e.g., dispositions and motives) and external (e.g., structural incentives) determinants of peaceful intergroup relations.

We argue that the use of economic games can effectively address these shortcomings, thereby providing a complementary tool for researchers studying the individual and institutional determinants of peace in humans. Economic games, particularly intergroup or team games (Bornstein, 2003), can serve as models of real-world contexts by replicating their incentive structures in closely regulated experimental environments (Guala, 2005; Thielmann, Böhm, Ott, & Hilbig, 2021).

This affords the opportunity to investigate how participants with diverse characteristics (e.g., in terms of group-based social preferences; Choi & Bowles, 2007; Columbus, Thielmann, Zettler, & Böhm, 2023) respond to varying structural conditions (e.g., costs and benefits of war and peace, respectively; target article, sect. 2). By employing economic games, it is possible to capture and disentangle the independent and joint causal effects of these factors in influencing peaceful intergroup conduct.

Previous research studying intergroup relations with economic games has mainly focused on conflict rather than peace, probably due to the higher salience of conflict. The workhorse of experimental studies of intergroup relations has long been the intergroup prisoner's dilemma (Bornstein, 1992). In this game, participants have a choice between selfishness and cooperation, which benefits their in-group and harms the out-group. Experimental studies using this and similar games indicate that individuals are willing to bear personal costs to benefit their in-group vis-à-vis the out-group when facing intergroup conflict (e.g., Bornstein, 1992; Bornstein & Ben-Yossef, 1994), particularly when their in-group is threatened by the out-group (Böhm, Rusch, & Gülerk, 2016; De Dreu et al., 2016). This has been taken as evidence that humans prefer to benefit in-groups and to harm out-groups (Choi & Bowles, 2007). However, when group members are given the opportunity to increase the in-group's welfare without harming the out-group (i.e., peaceful ignorance) – as modeled in the intergroup prisoner's dilemma-maximizing difference game – the majority prefers to do so (e.g., Halevy, Bornstein, & Sagiv, 2008; Weisel & Böhm, 2015).

The difference in behavior between the standard intergroup prisoner's dilemma and the intergroup prisoner's dilemma-maximizing difference highlights that the choice set available in a game constrains how participants can behave toward the out-group. An overall restrictive choice set can lead to false conclusions – such as inferring that participants are motivated to harm out-groups when they would prefer to peacefully ignore or even cooperate with the out-group. Even in the intergroup prisoner's dilemma-maximizing difference game, peace in Glowacki's sense – sustained positive-sum intergroup relationships – is simply not possible. This may lead researchers to overlook human preferences for peaceful interactions.

To address this limitation, recent research has devised extended variants of the intergroup prisoner's dilemma-maximizing difference game that additionally allow for peaceful cooperation, that is, costly contributions to benefit both the in-group and the out-group. When adding such an option in the intergroup parochial and universal cooperation game, Aaldering and Böhm (2020) found that roughly half of the contributions that otherwise would have been contributed to peaceful ignorance is contributed to peaceful cooperation instead.

Intergroup games also make it possible to test the role of individual differences in peaceful behavior under varying structural incentives. For example, Aaldering and Böhm (2020) found that peaceful cooperation was positively related to individual differences in prosocial intent (i.e., higher levels in honesty-humility and social value orientation; Ashton & Lee, 2009; Murphy, Ackermann, & Handgraaf, 2011) and negatively related to social dominance orientation (Pratto, Sidanius, Stallworth, & Malle, 1994), whereas peaceful ignorance was positively related to empathic concern (Batson & Shaw, 1991). These results suggest that there are specific individual differences related to different types of peaceful behaviors.

We call for further research to develop economic game paradigms that help to examine the very nature of peaceful motivations and behaviors in intergroup interaction. The intergroup parochial and universal cooperation game may be a useful starting point and its parameters can be varied to test predictions of Glowacki's account and from the related multidisciplinary literature on peace and conflict, for example, about the relative costs and benefits of peace and conflict (including punishment, reward, and potential differences in incentives within groups), social norms, signaling, power hierarchies, and leadership (and what characterizes those individuals who advocate for peace). For instance, to investigate how groups establish peace versus conflict, one could model groups whose members face varying incentives for peaceful versus harmful intergroup behaviors. Adding the possibility to punish their in-group members for specific contributions then allows to causally identify the structural conditions under which peace or conflict becomes the dominant social norm. Taken together, economic games can build the bridge between theoretical models and ethnographic studies to understand the formation and stability of peaceful intergroup relations.

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Creating shared goals and experiences as a pathway to peace

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Abstract

Glowacki offers many new directions for understanding and even eliminating the problem of war, especially creating positive interdependencies with *out-group* members. We develop Glowacki's intriguing proposition that in-group dynamics provide a route to peace by describing a prosocial motivational system, the caregiving system, that aligns individual interests and eliminates the need to use coercion to achieve mutually beneficial outcomes.

Climate change, nuclear and biochemical weapons exposure, pandemics, and "disruptive technologies" threaten life on earth. According to the bulletin of the atomic scientists who developed a "doomsday clock" to predict man-made global catastrophe, we are in a "time of unprecedented danger" (Mecklin, 2023). As we collectively step onto a precipice in which humanity might cease to exist, the "fog of war" continues to stymie human creativity and ingenuity (Morris, 2003) — the only tools we have capable of mitigating this crisis. Glowacki's "The evolution of peace," an anthropological analysis of the coevolution of peace and war, is teaming with new insights and approaches to international conflict that are seamlessly accessible to all, and simultaneously capable of ending war. These insights offer a road map for achieving a safe haven for international and interdisciplinary friendship and scholarship.

Glowacki's main thesis is that need-based sharing with interdependent out-groups provides the motivation for peace, which is a similar argument we have made in earlier work (Brown, Brown, Knickrehm, & Teske, 2005). However, Glowacki's intriguing contribution is that war begins with conflict *within* the group, as opposed to *outside* of it. He suggests that the decision to go to

war is almost always made unilaterally by a single individual (or relatively small collection of individuals) who elevate their own needs (e.g., for revenge, status, freedom) above the needs of the in-group or nation. According to Glowacki, war might be in the best interest of an individual, but peace is *always* in the best interest of the group.

Glowacki finds remedy in polydomous ants that share resources (peacefully) with other ants from spatially distinct nests. He writes that ants "achieve peace through an entirely different pathway unavailable to most animals" (target article, sect. 8, para. 7). These ants "achieve *positive-sum interdependent relationships*" with one another that align the interests of the in-group. As Glowacki puts it, "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" (target article, sect. 8, para. 7). Glowacki writes, "understanding how ants achieve [these] relationships will potentially provide new insights into the conditions that prevent and promote intergroup cooperation" (target article, sect. 8, para. 7).

In our own theoretical work, we have sought to understand these positive-sum interdependent dynamics, relying on Kropotkin's (1910) argument that the animal kingdom is better characterized by individuals helping one another than by individuals competing with one another (Brown, 1998, 1999; Brown & Brown, 2006). Positive-fitness interdependence occurs in social mammals, birds, and other species who share evolutionary fates. Although this often involves shared genes, fitness interdependence can also occur when individuals have a common experience or goal or fate, as when individuals play together, raise children together, or respond similarly to a perceived threat or life-enhancing opportunity. From an evolutionary perspective, these are all potential cues for shared reproductive outcomes.

Humanity is powerfully equipped to recognize states of fitness interdependence and respond to another's need with other-focused motivation, using what Bowlby (1969) has referred to as the "caregiving behavioral system" (Brown & Brown, 2015; Brown, Brown, & Preston, 2012). When the "caregiving system" guides behavior, we can expect a greater inclination toward developing interdependent alliances with out-group members. Importantly, there is supporting (and provocative) evidence that perceived interdependence is associated with interpersonal cooperation in everyday life (Columbus, Molho, Righetti, & Balliet, 2021) and in negotiation experiments (e.g., Cao, Kong, & Galinsky, 2020; Woolley & Fishbach, 2019), and with reductions in ethnic conflict in the real world (Varshney, 2002).

In discussing prerequisites for peace, Glowacki argues that "the key challenge" for society is that of replacing *in-group* social norms that reward aggression (e.g., Sherif, 1954) with ones that "prohibit aggression and implement coercive sanctions for those who violate them" (target article, sect. 3.3.2, para. 1). But how is norm replacement accomplished? Presumably, social norms are not arbitrary motivators of behavior; they emerge from behavioral interactions of group members (Morsky & Akcay, 2019), and, at least in some instances, reflect evolved solutions to specific adaptive problems, such as resource unpredictability (Kameda, Takezawa, & Hastie, 2003). In our view, a more direct and less coercive approach would start with identifying patterns of perceived fitness interdependence, positive and negative, and create or repurpose activities that bring people together in cooperative ventures. A key to preventing war might be to understand that two parties (*in- or out-group members*) who are driven to compete

fiercely or work in opposition to one another (negative interdependence) may, nevertheless, find it mutually beneficial to cooperate in an effort to help others (positive interdependence). Sherif identifies this basic strategy; however, he leverages the concept of a common enemy to create positive interdependencies among warring neighbors. By conceiving of positive interdependence more broadly, it may be possible to help everyone recognize their shared fate. As Kim Jong-un, supreme leader of North Korea, said, “I am a father ... I don’t want my kids to carry nuclear weapons on their backs the rest of their lives ... so let’s come up with solutions” (attributed by Woodward, 2020, p. 100).

The challenge for peacemakers would be to get each party to *reframe* negatively interdependent situations, and/or *reinforce* and *extend* the scope of those characterized by positive interdependence. To transition to interdependent social environments, groups would have to support the creation and maintenance (as opposed to disruption or dissolution) of close interpersonal relationships in the context of perceived safety, a prerequisite for activating the caregiving system. Unfortunately, cultural values that de-emphasize the importance of early childhood experiences (Ainsworth, Blehar, Waters, & Wall, 1978; Belsky, Steinberg, & Draper, 1991; Brown & Brown, 2015; Chisholm, Ellison, Evans, Lee, & Lieberman, 1993; MacDonald, 1997) and news media that thrives on threat do little to help in this endeavor. Nevertheless, the creative arts and the media are also promising tools for cultivating awareness of positive interdependencies with one another (Kullberg & Singer, 2012). As described by Jing et al. (2017, p. 2), “War or peace ... critically depends upon how the citizens and leaders of great powers *perceive* their interdependence” [emphasis added].

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A neurological foundation for peaceful negotiations

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Abstract

Glowacki explored the conditions required for peace and argued its preconditions arose only within the last 100,000 years. The present commentary addresses some major brain changes that occurred only in *Homo sapiens* within that period of time and the verbal and nonverbal cognitive sequelae of those neurological changes that may have aided the diplomatic negotiations required for peaceful solutions.

Glowacki explored the conditions required for peace and argued that its preconditions arose only within the last 100,000 years. Glowacki’s latter contention receives strong support from a majority of anthropologists, archaeologists, and paleoneurologists who contend that a cultural bloom took place associated with *Homo sapiens* more recently than 100,000 years ago. This cultural bloom included depictive cave paintings, highly ritualized burials, personal ornaments,

and long-distance trading for mates and resources (e.g., Coolidge & Wynn, 2018; Mithen, 1996). However, what has been neglected in his article is any mention of brain shape changes in *H. sapiens* within that time period and its likely cognitive sequelae for his “preconditions” and the cultural bloom. There is no mention in his text of the words “brain,” “cortex,” or “cognitive” that might be associated with those aforementioned archaeological aspects of modernity. It is the purpose of this commentary to address these lacunae. Specifically, I hypothesize that the well-documented expansion of the parietal lobes only in *H. sapiens* (but not in our extinct and close genetic cousins, the Neanderthals) in the last 100,000 years (e.g., Bruner, 2004, 2018; Pereira-Pedro, Bruner, Gunz, & Neubauer, 2020) may account for one critical component of conducting peaceful negotiations in proximal and distal trading, that is, diplomacy. It is also important to note that this superior parietal lobe expansion was accompanied by inferior parietal lobe displacement into the superior and posterior portions of the temporal lobes, known for their critical role in language comprehension and inner speech (e.g., Aboitiz, 2017; Coolidge, 2020).

The parietal lobes have a long- and well-established role in somatosensory functions, particularly visual and spatial processing, and the latter appears to be its original adaptive value in the evolutionary lineage of complex animal life, perhaps as early as 500 to 400 million years ago. This important role of the parietal lobes was especially critical in the origin of the primate lineage, beginning about 60 million years ago. These earliest primates (with whom we had a common ancestor) were small, socially gregarious, and were well adapted to arboreal life. Their arboreal niche required accurate placement of limbs navigating through branches and trees, a major function of the parietal lobes. The parietal lobes were also required for the learning and recall of locations and the integration between spatial references, specifically the translation and mediation between egocentric (self-centered or “own-eyes”) and allocentric (environmental, nonself, observer-like) perceptions (e.g., Mitchell, Czajkowski, Zhang, Jeffery, & Nelson, 2018). I have presented arguments elsewhere (e.g., Coolidge, 2014, 2023), as have others, that the parietal lobes may have been exapted (a change in the original function of a trait for a new purpose) for roles in numerosity (appreciation of numbers; e.g., Dehaene, 2011), the consolidation and recall of episodic (e.g., Allen & Fortin, 2013; Trimble & Cavanna, 2008) and autobiographical memories (e.g., Tulving, 2002), and in constructive future simulations (e.g., Baddeley, 2012; Schacter & Addis, 2020). However, I wish to emphasize the critical exaptive role of an inferior portion of the parietal lobes that may have played in the ability to conduct diplomatic negotiations and that is the retrosplenial cortex (RSC).

The corpus callosum, which transmits information between the two cerebral hemispheres is covered by the cingulate cortex. The posterior part of the cingulate cortex is the RSC, which is already well documented for its role throughout evolution in spatial navigation and in mediating and translating between egocentric and allocentric perceptions (e.g., Vann, Aggleton, & Maguire, 2009). I hypothesize that the *adaptive* functions of the RSC have been *exapted* to conduct successful diplomatic negotiations in more recent *H. sapiens*.

When one crosses even relatively short distances in Europe, India, or other regions in the world, a bewildering variety of languages is encountered, a condition undoubtedly similar to the later Middle Paleolithic and Upper Paleolithic periods (75,000

to 30,000 years ago) when fully modern *H. sapiens*’ brains and minds were in place and manifested themselves archaeologically by some of the aforementioned characteristics of modernity, particularly long-distance trading. There is archaeological evidence that these early *H. sapiens* were trading over 1,000 km (600+ miles), which strongly implies that a lingua franca was unlikely. Further, natural tendencies of xenophobia and other anxieties associated with dealing with strangers had to be overcome. Webb, Schweiger Gallo, Miles, Gollwitzer, and Sheeran (2012) empirically demonstrated effective emotional regulation requires identifying a need for emotional regulation in particular situations and enacting appropriate regulation strategies. Interestingly, they found that forming implementation intentions, specifically “if-then” planning, was significantly better (with a large effect size) at regulating one’s emotions compared no regulation instructions. More recently, King, Romero, Schacter, and St. Jacques (2022) determined the powerful influence of shifting from egocentric to allocentric perceptions upon autobiographical memories, that is, personal events recalled like movie clips coupled with semantic (script or word-like) details. In their empirical study, they found that shifting to allocentric perceptions of episodic memories reduced the emotional intensity of subsequent recall with no loss of semantic information.

The Webb et al. (2012) and King et al. (2022) studies support our (Coolidge & Wynn, 2012) earlier speculations about some of the cognitive prerequisites (nonorthogonal) for diplomacy, which includes adequate phonological storage capacity working memory to form complex thoughts, recursive thinking (e.g., “if-then” or “what-if” contingencies), and higher levels of theory of mind (the accurate reading of the thoughts, intentions, and attitudes or others). Thus, the gist of the present argument about the evolution of peace in the last 100,000 years rests on the dramatic neurological changes in the brain (specifically the RSC) and its consequential cognitive sequelae within that same period, which allowed for diplomatic negotiations, which in turn is an essential element of peace. By being able to regulate human emotions (like xenophobia), particularly because of its ability to translate between egocentric (how I feel) and allocentric (how they might feel) perceptions, fully modern *H. sapiens* were able to flourish after their entry into Europe about 50,000 years ago and then become the only surviving species of human primates.

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The evolution of peace (and war) is driven by an elementary social interaction mechanism

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Abstract

Here we revise Glowacki's model by proposing a simple and empirically tested mechanism that is applicable to a comprehensive set of social interactions. This parsimonious mechanism accounts for the choice of both cooperative and peaceful alternatives and explains when each choice benefits the interacting parties. It is proposed that this mechanism is key to the evolution of both peace and conflict.

Aiming to identify the conditions for the emergence of peace, Glowacki points to intergroup cooperation as a key selective force in human populations, taking into account the costs and benefits of intergroup cooperation for oneself, one's group, and the neighboring groups. Glowacki associates both peace and war with increased social complexity and argues that peace is best understood as a solution to a cooperative dilemma like the prisoner's dilemma (PD), chicken, or stag hunt games.

Indeed, mixed-motives interactions such as the PD game have often been proposed as models of peace and war (Axelrod, 1984; Axelrod & Hamilton, 1981). Nevertheless, they form only a fraction of all possible social interactions both from theoretical and ecologically-valid perspectives. When considering all two-by-two games, PD is only one out of 78 different strictly ordinal game types (Rapoport & Guyer, 1966), and one out of a total of 726 games when also including non-strictly ordinal games (i.e., games in which the same payoff may be repeated twice or more per player; Fraser & Kilgour, 1986; Kilgour & Fraser, 1988). The same also holds for other games such as chicken and stag hunt. Clearly, this count does not necessarily correspond to the frequency of occurrence of each game type in natural settings. Estimating games' actual frequency of occurrence, Northcott and Alexandrova (2015) suggest that PD games are uncommon among actual field cases, and thus have rarely been found in nature (Johnson, Stopka, & Bell, 2002). Therefore, learning to solve specific games, such as the PD, might be an insufficient condition for developing all-encompassing *successful* social strategies; specifically optimizing cooperative and confrontational behavior, and accounting for the evolution of peace and conflict.

Additionally, Glowacki suggests four necessary and significant preconditions for the development of peace in human populations. These include: (i) high-potential benefits from intergroup interactions; (ii) the ability to anticipate the behavior of strangers; (iii) the ability to regulate the behavior of group members; and (iv) the capacity to signal future cooperation intent of group members. Undoubtedly, these are valuable social skills that assist in managing both peaceful and conflictual interactions. However, learning to master all four preconditions is a complex and rather demanding requirement. Instead, one might want to consider a simpler, more elementary, and empirically validated mechanism that directs human choices across most social interaction types.

Here we propose a plain, fundamental, and empirically tested mechanism, which is applicable to the entire set of two-by-two games. This parsimonious mechanism, termed Subjective Expected Relative Similarity (SERS; Fischer, 2009, 2012), allows making optimal decisions and choosing cooperative and peaceful alternatives whenever they are expected to provide better outcomes.

SERS computes an expected value (EV) that integrates (i) the perception of strategic similarity with the other player (p_s), which indicates the probability of the opponent to choose an alternative identical to the alternative selected by oneself, with (ii) the payoffs expected under each choice. For example, consider two players choosing an alternative while interacting in a PD game, as depicted in Figure 1 (Flood, 1958; Rapoport & Chammah, 1965). Players who assume the other player is likely to choose the same alternative as themselves with the probability of p_s

	Cooperate	Defect
Cooperate	R, R	S, T
Defect	T, S	P, P

Figure 1 (Fischer et al.). Prisoner's dilemma game. Left and right payoffs in each cell indicate the payoffs for the row and column player, respectively. The game is defined by the inequalities: $T > R > P > S$ (and in some experiments also requires assuring $2R > S + T$).

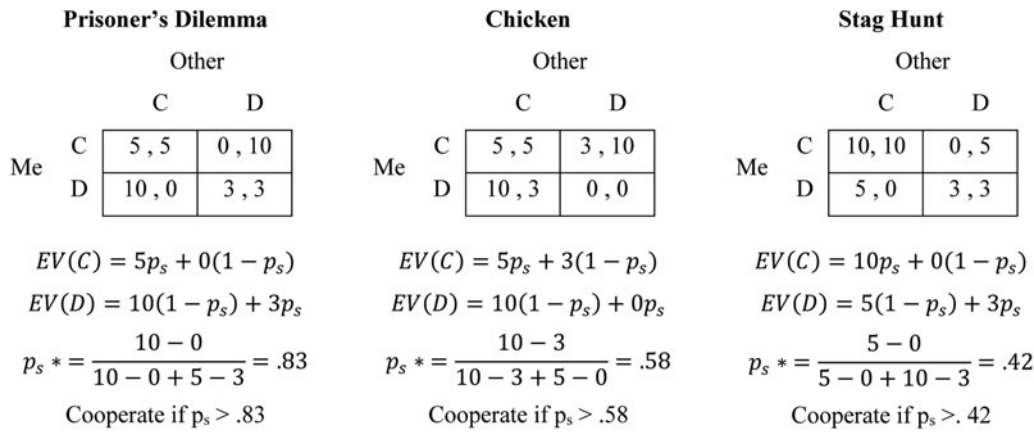


Figure 2 (Fischer et al.). Example of three game matrices, each showing two alternatives, termed C (cooperation) and D (defection), for each of the two players. Detailed under each matrix are: The expected values (EVs) for each alternative - EV(C) and EV(D), the game's similarity threshold (p_s^*), and the corresponding decision rule (where p_s denotes the probability of similarity with the opponent as subjectively perceived by each player).

(and the other alternative with the complementary probability of $1 - p_s$) may compare the EV for the choice of cooperation with the EV for the choice of defection, where $EV(\text{cooperate}) = Rp_s + S(1 - p_s)$ and $EV(\text{defect}) = Pp_s + T(1 - p_s)$, and choose the alternative that provides the higher EV. Further defining the critical threshold (p_s^*) where $EV(\text{cooperate}) = EV(\text{defect})$ results in $p_s^* = (T - S)/(T - S + R - P)$ and provides a *simple decision rule*: Cooperate whenever $p_s > p_s^*$, and defect whenever $p_s < p_s^*$. This simple rule optimizes individual payoffs and drives the convergence toward peaceful interactions, whenever they are advantageous for the parties. SERS has been: (i) shown to describe actual human behavior (Fischer, 2009, 2012), (ii) developed into an evolutionary computerized strategy that outperforms prominent strategies and learning algorithms (Fischer et al., 2013), and (iii) proposed as an explanation for individuals' strategic motivations and behaviors across a wide range of social interactions (Fischer et al., 2022). It has also been suggested that SERS explains both contemporary vaccination hesitancy and noncompliance with climate policies (Fischer, Rubenstein, & Levin, 2022). Figure 2 depicts examples of SERS-based decisions for PD, chicken, and stag hunt games.

By providing a single and fundamental payoff-maximizing strategy across a comprehensive set of social interactions, SERS accounts for both cooperative and confrontational behaviors, which may then evolve into more elaborate, either peaceful or belligerent, group interactions. Having a single plain strategy reduces cognitive loads, shortens response times, and hence streamlines social conduct. From an evolutionary perspective, a strategy that optimizes behavior across many games is likely to maximize expected payoffs, increase fitness, and shape social interactions. Importantly, SERS provides an explanation not only for the evolution of peace, but also for the evolution of conflict and war.

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Capacities for peace, and war, are old and related to *Homo* construction of worlds and communities

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Abstract

The capacities required for both peace and war predate 100,000 years ago in the genus *Homo* are deeply entangled in the modes by which humans physically and perceptually construct their worlds and communities, and may not be sufficiently captured by economic models.

This is a robust contribution to the literature on the evolution of warfare and peacemaking. We found many of the arguments to be compelling and agree with much that Glowacki presents. Here we extend and contextualize the argument Glowacki offers regarding evolutionary dynamics, commenting on the extent and complexity of cultural dynamics in the genus *Homo* as it relates to the emergence of peacemaking. We suggest a broader engagement with the range of Pleistocene data offers a deeper time frame and a bit more nuance.

Glowacki argues that peace is the product of cultural technologies that depend on factors that have recently emerged in our species' history, including social institutions and cultural mechanisms for preventing and resolving conflicts. We agree with the core argument and have published on it and related themes (Fuentes, 2017a; Kim & Kissel, 2018; Kissel & Kim, 2019). However, Glowacki implies that this suite of capacities to invent peace developed primarily within the last 100,000 years or so, drawing on, but different from, preexisting patterns of cooperation and conflict. This falls dangerously close to the refuted "behavioral modernity" versus "anatomical modernity" position (Kissel & Fuentes, 2021). We argue that the behavioral abilities that permitted the potential presence of warfare existed before 100,000 years ago and would also have allowed for the development of "peacemaking" (or "peacefare"; Kim & Kissel, 2018) as well. If members of the genus *Homo* could organize and cooperate in highly sophisticated ways, for example, hunting, material exchanges, cultural diffusion across large distances, complex care of injured and deceased, and other communal/joint activities (Brooks et al., 2018; Dapschaskas, Göden, Sommer, & Kandel, 2022; Hrdy & Burkart, 2020; MacDonald, Scherjona, van Veena, Vaesena, & Roebroeks, 2021; Spikins, Dytham, French, & Seren, 2021), and could use sophisticated communication and intergroup coordination in those endeavors, then populations of *Homo* could have started to develop and deploy capacities for peacefare well before 100,000 years ago. Glowacki acknowledges that underlying elements in these general patterns existed by ~300,000 years ago, but argues the key forms of social structure and cultural institutions of this earlier period did not resemble, sufficiently, the kinds he describes for later eras. Our view is that members of the genus *Homo* possessed the sufficient cognitive/physical/social toolkits, whether yesterday, 100,000 years ago, or 300,000 years, to develop the forms of cultural institutions necessary for peacefare (Fuentes, 2017b; Kim & Kissel, 2018).

In relation to the complexities in intergroup dynamics that solidify in the last few hundred millennia of the Pleistocene, Glowacki writes that intergroup exchange in particular allowed humans to build the cultural technologies beneficial in meeting the challenges of the ecological and social environments. Citing Polly Wiessner, Glowacki writes that more recent periods of peace may have fueled increased social complexity due to an expansion of exchange between groups that would otherwise be in conflict. Clearly this is possible. We would add here that periods of conflict, with constructions of identity/solidarity against outside groups, cooperation for defense as well as policing, and sacrificial ceremonies, may have also fueled substantive changes in social and technological complexity. These dynamics may also predate 100,000 years ago. One of us has argued previously how violent competition between factions/groups, both intra- or intersocietal, is a key factor for development of sociopolitical complexity and innovations in cultural institutions (Kim, 2020).

Glowacki suggests that for contemporary small-scale societies, participation is risky and conflict is motivated by a range of private incentives. We think much more can be said about motivations for populations of the genus *Homo* participating in coalitionary cooperation and conflict, particularly if they are to result in "positive-sum outcomes," which themselves would be highly complex and culturally contingent. Equally significant would have been cultural attitudes and perceptions about why violence is needed or ought to be actively avoided or restricted. This is, as partially noted by Glowacki, something that distinguishes human warfare and peacefare, even at small scales, from other kinds of coalitionary violence in other species (Kim & Kissel, 2018). Sometimes people participate because of a *perceived* attack or threat, and these perceptions could be related to beliefs that need not be physically manifest (Fuentes, 2019; Whitehead, 2004).

It is possible that Glowacki's focus on the core elements of game theory, economic models, and rational choice behaviors/incentives tends to elide much in actual motivations and belief systems, emphasizing instead the "rational" actor assessment. For humans, warfare and peacefare can be motivated by a *perceived*, and believed, collective good for the home community, even one that is not quantifiable. Arguably, participation in active warfare and peacefare can stem from a myriad of complex reasons and shared beliefs, much of which are simultaneously basis for, and derived from, cultural institutions and perceptions.

Glowacki's approach of creating positive-sum outcomes may not fully capture the variable nature of experiences in gains and losses for groups across the middle and terminal Pleistocene. Humans participate in warfare and peacefare for different reasons and in different contexts, many of which are not assessable primarily in an economic model, and these experiences may not be capable of being "summed." We might perceive positive-positive outcomes on the aggregate, but peace as a lived dynamic is highly variable and subjective, and is not an absolute condition (it may be marked by perceived conditions of peace for *some* but losses/injustices, unfair treatment for *others*). A generally positive-sum outcome may run the risk of overlooking negative conditions for some within a society. Peace for some might come at a cost for others. For instance, some might claim that American society today is generally at peace, but many community members might feel very differently (and rightfully so) given various kinds of conflict, injustice, and an absence of peace as related to outcomes from forms of cultural or structural violence (Kim, 2012).

In sum, we applaud Glowacki's exploration of the conditions required for peace and war and welcome more discussions on

how these are not opposites but epiphenomenal of deeper issues of how humans construct their worlds and communities.

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Social and economic interdependence as a basis for peaceful between-group relationships in nonhuman primates and humans

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Abstract

Glowacki asserts that interdependent relationships beyond group boundaries are exceptionally rare among nonhuman mammals. However, rudimentary forms of interdependence can be seen in primate species that form multilevel societies, that is, core social units embedded within higher-level grouping categories. Studies of primate multilevel societies can enrich discussions about the evolutionary origins of peaceful between-group interactions in humans.

Between-group peace and cooperation are critical for navigating pressing societal challenges such as security threats and climate change, and as attested by the timely target article by Glowacki, humans have an arsenal of strategies at their disposal to establish, maintain, and restore peace. I generally concur with Glowacki that stable interdependent relationships crossing group boundaries are the province of humans. However, are they really exceedingly rare among nonhuman mammals, including nonhuman primates? Here, I argue that they are not, and that by examining potential parallels between humans and nonhuman primates with multilevel societies we can better characterize the frequency and predictors of peace in primates.

As pointed out by Glowacki, some primate taxa exhibit peaceful encounters between groups (e.g., western gorillas, Forcina et al., 2019; white-handed gibbons, Reichard & Sommer, 1997) and even cooperative interactions (bonobos, Tokuyama, Sakamaki, & Furuichi 2019). However, as Glowacki notes, these tend to be *transient* (Grueter & Wilson, 2021). Rudimentary forms of interdependence resembling *durable* positive-sum relationships do seem to occur in species that feature multilevel societies. Multilevel societies, that is, where multiple core social units coalesce in a semi-interactive manner to form higher-level “clans,” bands, and communities, are best known from snub-nosed monkeys, papionins, and humans (Grueter, Chapais, & Zinner, 2012; Grueter et al., 2020; Rodseth, Wrangham, Harrigan, & Smuts, 1991). Mechanistically, a multilevel system emerges through coordinated behaviour among the core units and persistent mutual tolerance. The adaptive utility of this complex nexus of social interactions lies in its members being able to concurrently reap the benefits of multiple social levels, for example, access to cooperation partners at the band level and access to social services such as grooming or allocare at the core unit level (Grueter et al., 2020).

The between-unit tolerance underlying multilevel societies is evolutionarily stabilized by several interactive forces, for example, the need for collective defence against external adversaries, the need to access patchily distributed resources and the existence of supragroup kin networks. Similar forms of social and economic interdependence can also explain peaceful intergroup relationships in humans.

In humans, *between-group competition* represents a major selective force for the evolution of intergroup peace and suprafamilial groupings (Alexander, 1990). The need for cooperative defence (or aggression) against shared external threats may suppress in-group favouritism and elicit amicable sentiments to neighbouring communities. A contemporary real-life example includes Russia’s invasion of Ukraine which improved Ukraine’s relationship with its allies, and the relationships among its allies (especially among European Nation states). Exposure to a common threat (such as a terrorist attack) can also cause strangers

to identify themselves as belonging to a uniform social entity (Drury, Cocking, & Reicher, 2009). In primate/animal multilevel systems, a similar catalyst for the emergence of tolerance between members of different units is an external threat which can originate from conspecifics or predators. Through aggregation for common defence, different groups can pool the risks of foreign threats (Camerlenghi, Nolazco, Farine, Magrath, & Peters, 2023; Grueter & van Schaik, 2010; Kummer, 1968; Xiang et al., 2014).

Economic and ecological interdependence such as trade of subsistence goods or mutually agreed-upon permission to use shared territories can also function against the waging of war in humans (Fry, 2012; target article). Such symbiotic exchange networks between groups are critical in environments in which variance in resource access among groups is high because they can act as a buffer against resource failure in one's area (Kelly, 2013; Pisor & Gurven, 2016; Wiessner, 2002). Evidence from both small- and large-scale societies shows that a densification of trade alliances can effectively prevent intersociety and interstate war (Grueter & White, 2014; Jackson & Nei, 2015). Ecological interdependence may also explain intergroup tolerance in some primates, in particular those with multilevel societies. When critical resources across neighbouring ranges are heterogeneously distributed, gains to exclusive access could be reduced. The resulting relaxation in intergroup relations provides scope for intergroup tolerance (Jaeggi, Boose, White, & Gurven, 2016; Robinson & Barker, 2017) and higher-level social structures such as multilevel systems, as long as these do not impose unsustainable costs on its constituents (Grueter & White, 2014; see also Macdonald & Johnson, 2015).

In humans, reciprocal *exogamy*, whereby individual dispersal for marriage suppresses latent violent tendencies and perpetuates alliances based on consanguineal and affinal kinship between groups, has been argued to be a strong determinant of nonwarring relations in small-scale societies (Chapais, 2008; Lévi-Strauss, 1949; Rodseth et al., 1991; but see Grueter & White, 2014; Kang, 1979). In primates, the buildup of kin networks encompassing multiple units and the opportunity for members of different units to interact regularly may also foster between-group tolerance. Shared descentance resulting from localized dispersal, social viscosity, and extragroup matings may be the source of reduced aggression between neighbouring groups and facilitate the formation of affiliative intergroup associations (Mirville et al., 2018; Reichard & Sommer, 1997; Rodrigues, Barker, & Robinson, 2023; Snyder-Mackler, Alberts, & Bergman, 2014; see also Camerlenghi et al., 2022).

A comparison between nonhuman primates and humans will help us understand if the prevalence of peace in human intergroup encounters can be explained with the canonical factors proposed for primates. It does seem that some of the same drivers can generate and stabilize between-group peace in humans and primates (i.e., mutual access to resources in ecologically complementary environments, collective group defence, and "exogamy") although these take more elaborate forms in humans. However, what is unique to human peace systems is a cultural overlay that prescribes the adherence to peace norms (target article). This narrower definition of peace does not apply to nonhuman multilevel societies. However, if we use the less restrictive definition of tolerance and motivation to interact across group boundaries, then peace is present in nonhuman multilevel societies, albeit in more embryonic forms.

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Peace in other primates

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Abstract

We elaborate on Glowacki's claim that humans are more capable of establishing peace than other mammals. We present three aspects suggesting caution. First, the social capabilities of non-human primates should not be underestimated. Second, the effect of these capabilities on peace establishment is nonmonotonous. Third, defining peace by human-centered values introduces a fallacy.

We welcome Glowacki's conceptual framework to describe and interpret the origins of human peace. We question the author's evaluation of the large discrepancies in the potential for peace between humans and other primates like chimpanzees and bonobos. Specifically, we argue that the competencies of other primates for peace, defined as the harmonious cooperation with outcasts and between different (sub)groups, are dismissed too easily. In response, we focus on three themes, namely, (1) the underestimation of nonhuman primate social capabilities, (2) the nonmonotonous effect of these capabilities on peacemaking, and (3) the anthropomorphization fallacy that might occur when the explanandum (here, the goal state of peace) is defined by human-centered values (e.g., equal responsibilities and rights across individuals and groups).

According to the author, peace between different groups is, among other capabilities, preserved by the capacity for social regulation, which is introduced as a key component of human cognition. This capacity, however, can also be observed in other primate species. Young chimpanzees, for example, learn to use new tools in directed interaction with older adults, while the latter receive physical attention in return (e.g., grooming). Likewise, chimpanzee males aspiring to lead their group benefit from strong social bonds. Accordingly, older adults often rise in the social hierarchy thanks to their sociability rather than dominance or physical strength (Newton-Fisher, 2004; Sandel et al., 2020), a balance that is also critical for human leaders to prevent conflict or a revolt (Krueger et al., 2022). Chimpanzees also show capacities of

norm compliance and enforcement: In fact, it seems that they have a clear division of roles for conflict resolution (de Waal, 2022), for example, with the old females being able to settle aggressive disputes between young males. We want to make clear that the social components that are introduced as key human cognitions to facilitate peace – such as social learning and reciprocal behavior, as well as norm compliance and enforcement – are not lacking in other primates. At most, they are lesser in their extent.

Centrally, we want to make a plea for caution to conclude that humans are best equipped to establish and maintain peace, even if we assume their social capabilities to be comparatively high. In this regard, we present two arguments: First, we should not expect a monotonous effect of the presented key capacities to facilitate peace. For instance, an increased utility of intergroup cooperation leads to more intergroup interaction and more diverse kinds of interaction. Both can foster unique conflicts. That is, the complexity of human social interactions breeds error and misunderstandings. A more focused and reduced interaction with out-groups might, in some cases, be beneficial for a harmonious relationship between the groups. Similarly, the effects of norm enforcement on peace are ambiguous. If the enforcement reaches a certain extent, the attainment of peace should become less likely because individuals revolt in efforts to restore a measure of personal power and freedom.

Second, we urge caution to not commit the fallacy of defining the goal (i.e., peace) and conclusion (i.e., peace is most pronounced in the human species) by the starting point (i.e., human strengths and values). The result might be that the concept of peace is overfitted to human commonalities, rendering comparisons with other species confounded. As an illustration, peace as the “presence of generally harmonious relationships” (target article, sect. 1.1, para. 5) can refer to very different relational states. An egalitarian interaction and norm enforcement (i.e., equal responsibilities and rights among groups) might be what many would understand as a humane goal. However, a relationship between individuals as well as groups can be as harmonious without equality at its center but rather the opposite: A coalition between groups (e.g., tribes, kin groups, or clans) strictly led by one of the groups. Even between primate species this difference is apparent. While chimpanzees maintain harmony with a high asymmetry of power, bonobos do the opposite, preserving more of a democratic distribution of responsibilities and rights (de Waal, 2022). Both types of harmony are equally functional, leaving open the question of how to compare them with each other, let alone rank one above the other. We suggest that demonstrating interspecies discrepancies by applying human concepts of peace to other mammals may reflect interspecies differences in values rather than differences in capabilities to achieve peace, when peace as the harmonious intergroup relationship can be reached by several different means.

In conclusion, we appreciate Glowacki's attempt to provide an exhaustive perspective on the evolution of peace in humans. In our commentary, we seek to amend his framework by reevaluating other primates' social competencies and their potential for peace. We specifically point out that other primates like chimpanzees and bonobos show key components for peace the author presents, and we further argue that high degrees of these components are not exclusively beneficial for peace (between and within groups). Lastly, we advise caution in using human concepts of values and peace to conclude that peace can be especially facilitated

by humans compared to other primates and mammals in general. This anthropomorphization commits the fallacy of defining the conclusion by its starting point.


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Impediments to peace

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Abstract

While effective institutional practices are critical for the evolution of peace certain factors deter their effectiveness. In-group and out-group dynamics may make peace difficult between culturally distinct groups. Critical ecological conditions often lead to intractable conflict over resources. And within group conflicts of interest most prominently between generations may inhibit effective peace making.

I very much like the approach taken here on evolution of peace and the norms and institutions that enforce effective conflict resolution. It is a much needed perspective that ought to be more strongly researched. Far too many articles are narrowly unbalanced as they address the causes, conduct, frequency, intensity (mortality rates), and consequence of war in preindustrial societies. I currently teach a course on the anthropology of war and thanks to Glowacki's comparative research I include some of the material presented here in that course.

In the study of origins of peace, groups such as the Pygmies and southeast Asian societies are often problematically used as evolutionary models of hunter-gatherer peace. As Glowacki and others have argued many of these societies are either strongly tied or have been pacified by more powerful nonforagers or otherwise have had their social system disrupted making war costly (Ember & Ember, 2014, pp. 2–3). More to the point, a historical comparison of groups before pacification (e.g., colonial administration) and after pacification (Ember & Ember, 1994) shows

that the frequency of war declined strongly after pacification. Thus the use of postpacification descriptions of preindustrial warfare to understand indigenous cultural factors behind peacemaking is problematic. Glowacki's strong survey of the peacemaking literature will inspire others to further examine the conditions under which effective conflict resolution practices emerge. To this end, I will focus on lingering problems making the achievement of peace difficult such as resource competition, external warfare, the psychological dimensions of in-group and out-group dynamics, and the warrior complex.

Glowacki states "The key factor is not that a subsistence strategy necessarily yields either war or peace... but rather that social and cultural features constrain and influence behavior by shaping the payoffs associated with war and peace" (target article, sect. 9, para. 3). Although Glowacki notes that competition over scarce resources is a problem, in some instances I feel this may at times be a nearly intractable problem and thus crucial. Comparative research (Allen, Bettinger, Coddington, Jones, & Schwitalla, 2016; Dow, Mitchell, & Reed, 2017; Ember & Ember, 1992; Kelly, 2013) shows strong correlations between warfare frequency and intensity and resource competition. I say intractable because in places like highland New Guinea population densities are extremely high (Brown & Podolefsky, 1976) such that agricultural intensification through mounding, mulching, ditching, and so on has perhaps reached its limits given local technology. In a comparison of 26 New Guinea societies Ember (1982) demonstrated a correlation between war and population density. Comparative data also reveal that food producers (pastoralists, horticulturalists, and agriculturalists) have greater frequency of warfare compared to hunter-gatherers (Ember & Ember, 2014; Wrangham, Wilson, & Muller, 2006). Among hunter-gatherers it is likely the case that the benefits of war in terms of access to low-density resource and unimproved foraging areas is less than that for food producers gaining access to improved and high-density resource areas. Plus those who are attacked are more likely to defend themselves because they are vitally tied to their lands.

Early on Glowacki states he avoids the distinction between internal and external war. I think this is a mistake if we are to understand conflict resolution. Internal war refers to warfare within the same ethnolinguistic group or "cultural unit" (Otterbein, 1973) while external war refers to war between different cultures. In external war enemies speak different dialects or languages, may have different means for conflict resolution, and so on. Through socialization (Ember & Ember, 1992) these and other differences may ultimately lead to greater fear, hatred, and mistrust of outsiders (Hewstone, Rubin, & Willis, 2002; McDonald, Navarrete, & Van Vugt, 2012). In contrast, internal war pit groups who speak the same language, typically intermarry and trade, and may celebrate common religious events. Clearly those groups who speak the same language and follow the same conflict resolution practices are much more likely to be able to negotiate peaceful resolutions of conflict. In a survey of lowland South American warfare Walker and Bailey (2013) show that body counts or the number of deaths per conflict is greater in external war (10 deaths) than internal war (3.7 deaths) even though internal war is more frequent (Table 2). In external war they conclude "External revenge raids kill more people on average than the original grievance, indicating a tendency towards escalation in violence and increasingly vicious cycles of revenge killings between ethnolinguistic groups" (Walker & Bailey, 2013, p. 32). van der Dennen (1995, p. 78) in his comprehensive survey of tribal warfare also notes that external

war is more likely to be ethnocentric and genocidal. Whether these generalizations are accurate requires further research.

In the field of social psychology, the distinction between internal and external warfare is directly relevant to the well-studied social psychological literature on out-group and in-group relations and attitudes that appears to be a human universal. Out-groups are easily demonized by in-group members especially in a competitive context (Efferson, Lalive, & Fehr, 2008). Importantly, classification of out-groups and in-groups can be quickly changed based on common interests (Kurzban, Tooby, & Cosmides, 2001).


Glowacki notes a fundamental conundrum when he states, “Status is almost universally accorded to warriors, providing an important arena for men in the same society to compete with each other for status” (target article, sect. 2.2, para. 1). As he documents, older males who have gained their status through military valor often caution or punish young males who attempt to use the same means to achieve status when they feel hostilities should cease. Thus there is a conflict of interest. This does not mean that older warriors are trying to instill peaceful values after gaining their status through military valor. They may believe that war may not be expedient in certain instances. Presumably, a warrior culture is an adaptive feature in societies where it is found because of the benefits of deterrence and/or acquisition of fitness enhancing resources.

Competing interest. None.

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The importance of social rejection as reputational sanction in fostering peace

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Abstract

I challenge the idea by Glowacki that “strong sanctions” such as fines, physical punishment, or execution are more effective in promoting peace than “weak punishments” like social rejection. Reviewing evidence that social rejection can have significant social and psychological costs for norm violators, I propose that social rejection can serve as a powerful reputational sanction in fostering peace in society.

In discussing societal norms to develop peace, Glowacki proposes that “weak punishments” – reputational sanctions including exclusion and ostracism – are less effective in deterring war and peacebreaking than “strong sanctions” such as fines, physical punishment, or execution. Challenging this perspective, I review psychology and justice research that suggests, as opposed to physical and monetary punishment, social rejection (i.e., being excluded from a social group, culture, or society) can impose substantive social and psychological costs on norm violators. Accordingly, I argue that social rejection can more efficaciously rein in norm-violating behaviors of violence and aggression. It serves as a potent reputational sanction in promoting peace in society.

Despite being a less harsh form of punishment, social rejection such as exclusion and ostracism brings numerous negative consequences on individuals’ social standing and psychological needs. Rejected individuals experience concern for their precarious social image and suffer from negative feelings and emotions inclusive of anxiety, depression, and loneliness. Even associated health problems such as immune system and sleep issues may emerge (for a review, see DeWall & Bushman, 2011). Furthermore, such sanction takes a toll on individuals even in brief, innocuous episodes of social rejection, for instance, when a passing stranger looks through them as if they were air (Wesselmann, Cardoso, Slater, & Williams, 2012). In light of the adverse impacts that social rejection has on reputation and psychological well-being, reputational punishment in the form of exclusion entails norm violators paying social and psychological prices for their deviant behavior.

In addition to inflicting social and psychological costs on peace breakers, social rejection can cause a level of distress equivalent to physical pain, extending beyond its reputational and socio-psychological functions. Research has shown that this social and psychological pain can be as detrimental as physical injury (DeWall et al., 2010a; Kross, Berman, Mischel, Smith, & Wager,

2011) typically associated with physical punishment. This is evidenced by an fMRI study that found activation of several brain regions involved in physical pain during social rejection (Eisenberger, Lieberman, & Williams, 2003). Based on findings from this line of work, sanctions of social rejection, as I explicate below, may become powerful tools to harness norm-violating behaviors of aggression and violence. To circumvent these significant costs of rejection, be they social, psychological, or seemingly physical, would-be peace breakers in a group should behave and adhere to norms for nonaggression toward others. Transgressors who have already violated societal norms could also be motivated to compensate for the harm caused and avoid reoffending.

On the contrary, while it is often assumed that strong sanctions (in this case, fines, physical punishment, and execution) can deter norm violations by being perceived as a formidable threat, ample studies in psychology and justice suggest otherwise. In actuality, severe sanctions may even have the opposite effect, potentially initiating a vicious cycle of violent behavior instead of curbing deviant actions and crimes. This is in contrast to beneficial, peaceful outcomes which Glowacki believes. For example, Heilmann et al. (2021) concluded in their review that physical punishment is associated with increased behavioral problems, in particular, aggressive behaviors over time. Other psychology and behavioral scholars corroborate this perspective and caution against the use of physical punishment (Grogan-Kaylor, Ma, & Graham-Bermann, 2018). Researchers in criminal justice also question whether the enactment of severe sanctions in legal settings can reduce recidivism of the guilty (Smith, Gendreau, & Goggin, 2002), with some even demonstrating provocative, undesirable criminogenic effects caused by stronger punishment (Bales & Piquero, 2012). Consistent with this view, Teodorescu, Plonsky, Ayal, and Barkan (2021) in a series of experimental studies indicated greater effectiveness of small (but frequent) punishments over severe (but rare) punishments (e.g., large fines) in reducing moral violations. Thus, their findings demonstrate the magnitude of punishment is less of a crucial factor in deterrence effects.

As reviewed above, it is plausible to suggest that social rejection (“mild punishment”) can be no less – and even more – effective than physical punishment and fines (“strong punishment”) in facilitating meaningful behavioral changes in society. This is because human beings have a strong and innate need to belong (Baumeister & Leary, 1995). Social rejection, as a punishment against those who violate societal norms of peace, poses substantial threats to the fundamental need for acceptance by others and important social groups. Given that social rejection causes individuals to become attuned to potential sources of acceptance, it presumably has the ability to deter counter-normative behaviors which may lead to further ostracism. It is especially true when norm violators recognize peaceful behaviors relative to socially unacceptable aggression constitute normative actions necessary for being embraced within the community. Eventually, this helps drive the development of peace in human society.

Although social rejection as a reputational sanction can arguably be more helpful than strong sanctions, it is not to say rejection is uniformly advantageous in fostering peace. Few studies have suggested that certain or extreme forms of social rejection might increase the excluded individuals’ aggression

tendency (Twenge, Baumeister, Tice, & Stucke, 2001). However, providing socially rejected individuals with even a brief experience of acceptance can reduce their levels of aggression (DeWall, Twenge, Bushman, Im, & Williams, 2010b) and further induce them to engage in prosocial and cooperative behavior to achieve peaceful outcomes if doing so earns them social acceptance from others (Maner, DeWall, Baumeister, & Schaller, 2007).

In conclusion, while Glowacki argues for the effectiveness of strong sanctions to enforce nonviolence norms and promote peace, I contend, from a psychology and behavioral perspective, that social rejection as a reputational sanction can be just as efficacious, if not more so, in upholding these norms. We should not only deprioritize severe punishment but also reconsider the potential and efficacy of social rejection or even other forms of weak punishment. Doing so can offer valuable insights for researchers and policymakers to understand progressive measures against violations of peace. These implications, in both theory and practice, ultimately contribute to the evolution of peace in our society moving forward.



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Experimental evidence suggests intergroup relations are, by default, neutral rather than aggressive

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Abstract

The target article offers a game-theoretical analysis of primitive intergroup aggression (i.e., raiding) and discusses difficulties in achieving peace. We argue the analysis does not capture the actual strategy space, missing out “do-nothing.” Experimental evidence robustly shows people prefer doing nothing against out-group members over cooperating with/attacking them. Thus, the target article overestimates the likelihood of intergroup aggression.

In the target article, Glowacki offers the game-theoretical analysis of war and peace. Glowacki further argues that each member of groups face a social dilemma in which they have to make a choice between intergroup cooperation (cooperation) and conflict (defection), and, all members of both groups must choose intergroup cooperation to establish peace (Fig. 1 in the target article). Referencing anthropological and archaeological evidence, Glowacki pointed out that social structures were necessary for people to coordinate individuals’ behaviour so that they could establish peace.

We would like to first point out that Glowacki’s game-theoretical analysis fails to represent the true strategy space; more specifically, Glowacki rules out the strategy of “doing nothing” and assumes that people either cooperated or attacked an out-group member (see Fig. 1). We argue that the lack of the strategy in Glowacki’s discussion leads to an overestimation of the likelihood of people initiating intergroup conflict and an overstatement of the role of social structures in helping people avoid intergroup conflict and promoting peace.

Intergroup cooperation and conflicts have been extensively studied in the experimental literature in psychology (Balliet, Wu, & De Dreu, 2014; Everett, Faber, & Crockett, 2015), economics (Charness & Chen, 2020), and evolutionary biology (Rusch, 2014; Rusch & Gavrillets, 2020). Regarding intergroup cooperation, previous studies have documented in-group favouritism, using a variety of economic games such as prisoner’s dilemma, dictator, trust, and public goods games, and they have robustly shown that it is increased in-group cooperation, rather than reduced out-group cooperation that explains in-group favouritism (Aaldering, Ten Velden, van Kleef, & De Dreu, 2018; Balliet et al., 2014). That is, people do not discriminate between out-group members and strangers whose group membership is unknown. In other words, people do not actively reduce out-group cooperation (i.e., out-group hate).

	Cooperation	Do Nothing	Aggression
Cooperation	Cooperation	Neutral	Conflict
Do Nothing	Neutral	Neutral	Conflict
Aggression	Conflict	Conflict	Conflict

Figure 1 (Imada and Mifune). Peace as an elaborated prisoner’s dilemma.

Regarding intergroup aggression, Mifune and colleagues developed the preemptive strike game in which two players choose between preemptively attacking their partner and doing nothing until the end of the game (Mifune, Hizen, Kamijo, & Okano, 2016; Mifune, Simunovic, & Yamagishi, 2017; Simunovic, Mifune, & Yamagishi, 2013). Using the game and focusing on arbitrarily created experimental groups (i.e., minimal groups; Tajfel, Billig, Bundy, & Flament, 1971), they have consistently found that people are *not* more likely to preemptively attack an out-group partner than an in-group partner. In other words, when people are presented with a choice between the intergroup aggression and do-nothing strategies, the latter is preferred.

Importantly, previous studies using the preemptive strike game have also revealed that people by default do not hold the expectation that out-group members are aggressive towards in-group members. This suggests that people expect out-group members to choose do-nothing rather than aggression. This is in stark contrast to Glowacki’s argument that people originally lack the expectation that out-group members are not aggressive.

Nevertheless, while out-group membership per se does not lead people to believe that out-group members would attack them, some concrete out-group memberships such as certain nationalities may elicit such a belief (Jing et al., 2017; Romano, Gross, & De Dreu, 2022). Jing et al. (2017) let participants play the preemptive strike game using national intergroup contexts rather than minimal group contexts. They found that Japanese participants were more likely to preemptively strike their partner when the partner was American or Chinese, compared to when their partner was Japanese. Similarly, Chinese participants also displayed the increased tendency to preemptively attack others when their partner was Japanese or American as compared to when their partner was Chinese. Yet, Americans did not show such a tendency, replicating the studies using the minimal group contexts. More recently, Romano et al. (2022) revealed that people expect others from certain nations to be more aggressive and competitive than they actually are. The comparisons of the findings from minimal versus actual intergroup contexts suggest that there are situations and intergroup contexts that mirror the Glowacki’s view that intergroup conflicts are inevitable without social structures. In other words, there are some

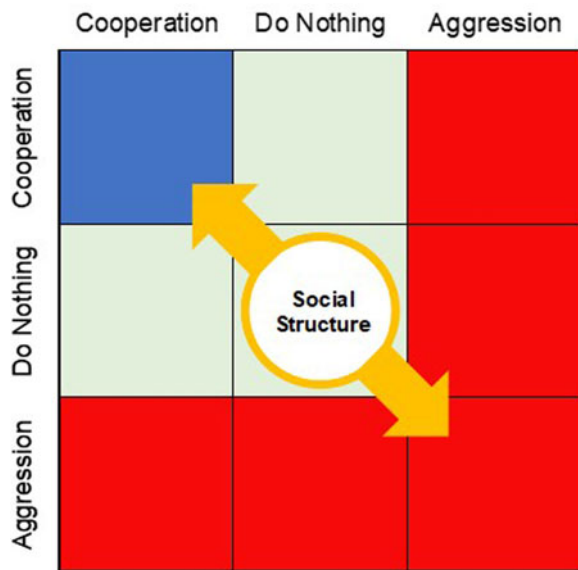


Figure 2 (Imada and Mifune). Revised role of social structures in coordinating people in the dilemma.

contexts in which intergroup aggression dominates do-nothing and individuals need social structures to get out of intergroup conflicts.

Empirical support for the absence of the tendency to attack out-group members also comes from studies using intergroup prisoner's dilemma-maximizing difference game (IPD-MD; Halevy, Bornstein, & Sagiv, 2008) and its variants (Aaldering & Böhm, 2019; Wit & Kerr, 2002). In IPD-MD, for instance, participants can choose between selfish, weak parochial cooperation (in-group cooperation + do-nothing to out-group members), and strong parochial cooperation (i.e., in-group cooperation + out-group aggression). Previous studies have demonstrated that people have a strong preference to weak over strong parochial cooperation (Mifune, 2022; Weisel & Zultan, 2021; Yamagishi & Mifune, 2016).

In summary, the series of the experimental evidence suggest that the do-nothing strategy is dominant when people could choose between cooperation, aggression, and do-nothing. Similarly, people would expect out-group members to prefer the do-nothing strategy. As such, we argue that Glowacki overestimated the tendency of people to initiate intergroup aggression without social structures. Starting from the overestimated tendency to instigate intergroup aggression and the likelihood of intergroup conflict, Glowacki discusses the role of social structures (i.e., hierarchies and leadership) in coordinating people's interests and argues that they either *enables and facilitates* mutual cooperation or *exacerbates* intergroup conflicts. As such, Glowacki does not discuss how social structures *instigate people to initiate intergroup conflicts*. In light of the experimental evidence, we argue that it is fruitful to revisit the roles that institutions and leadership played in steering intergroup relations. Namely, it is of vital importance to elucidate how social structures help people move from the mutual do-nothing towards peace and war (Fig. 2).

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Competing interest. None.

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A game of raids: Expanding on a game theoretical approach utilising the prisoner's dilemma and ethnography in situ

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Abstract

In this commentary, we set out the specifics of how Glowacki’s game theoretical framework for the evolution of peace could be incorporated within broader cultural evolutionary approaches. We outline a formal proposal for prisoner’s dilemma games investigating raid-based conflict. We also centre an ethnographic lens to understand the norms surrounding war and peace in intergroup interactions in small-scale communities.

Cultural evolutionary theory can be used to investigate pathways to peace by examining norms for peace historically and across cultures. Researchers have applied game theory simulations to existing and historic interactions between nations extensively (see O’Neill, 1994, for a full review). Glowacki extends these models to understand the conditions that are required for the *evolution of peace within small-scale communities*. These interactions are raid based, with groups operating attacks for resources followed by retaliation. Building on Glowacki’s framework, we describe specific considerations for a game theoretical approach, and propose that modelling (e.g., Bunce & McElreath, 2017; Cohen, Lewin-Epstein, Feldman, & Ram, 2021) alongside ethnographic research, can help determine causal relationships between different cultural norms which are thought to influence the establishment of net sum positive interactions, that is, peace.

Glowacki suggests the use of prisoner’s dilemma game. Prisoner’s dilemma games have been used since Axelrod and

Hamilton’s (1981) *The Evolution of Cooperation*. A crucial consideration when using game theory to determine cultural evolutionary traits is that it maps closely onto real life by capturing cultural complexities, ensuring ecological validity (Pisor, Gervais, Purzycki, & Ross, 2020). We propose that to represent intergroup interactions over time, iterated prisoner’s dilemma games should be played. Iterated prisoner’s dilemmas have been found to create tit-for-tat cooperative structures on all bar the last round, where the optimal strategy is to defect (Axelrod & Hamilton, 1981). It is impossible for “last rounds” to be known within traditional raids; therefore, iterated games can accurately match such events.

A traditional prisoner’s dilemma where participants are anonymous allows for the simulation of real-life unclear threat of retaliation, just as it may be in raid-based warfare, where groups attack without knowing who was originally behind the raid. By allowing individual identities to be known to other players within games, using recipient identity-conditioned heuristics improves the validity of recreating decision making relating to resource acquisition within social networks (Gervais, 2017). As resources must be established for raids to be undertaken, and intragroup negotiation is often taken on the possibility of retaliation, there is clearly communication between and within groups. For the prisoner’s dilemma to be representational, one group’s choice would be communicated before the other group participates. This would simulate a raid being carried out, and the other group being aware that the choice to cheat had been made, before they in turn decided to cooperate or defect.

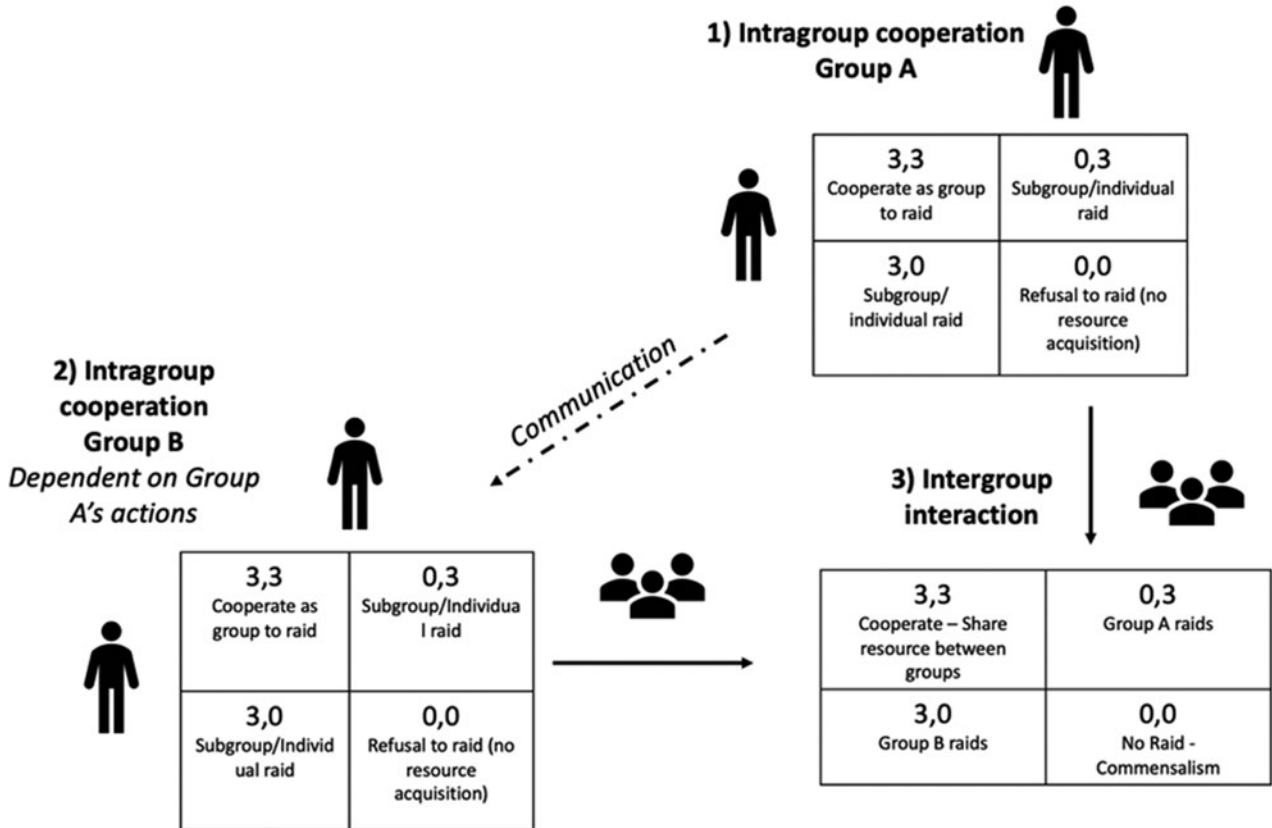


Figure 1 (Jeffries et al.). Suggested model for a sequential prisoner’s dilemma game featuring intragroup cooperation towards a raid to gain additional resources, the response from the target group (B) and the intergroup prisoner’s dilemma matrix this results in, allowing for a more comprehensive understanding of the evolution of peace in small-scale societies.

Using a sequential game to establish actions between communities could mirror the intragroup interactions mentioned by Glowacki. A prisoner's dilemma game could be played *within* a society negotiating a raid, where cooperation among the group would be akin to all agreeing to go on a raid and gain maximal resources, while cheating may lead to a smaller individual raid (Fig. 1). In this case, the cooperative act paradoxically results in warfare, and for peace to be established all members of the group must effectively defect by refusing to raid the adversary group and thus not acquiring potential resources. However, despite including a measure of intragroup collaboration, hierarchies are often in place within societies that game theory could miss. Certain additional games such as the pirate game could implement these hierarchies where members are ranked and the most prestigious chooses how to distribute the resources (Moulin, 1986).

There are other games that could also be applicable, including stag hunt and chicken. Stag hunt is similar to the prisoner's dilemma but allows for evolutionary stability within cooperation and defection. This can be seen as a positive within the models suggested above, as a game for intragroup cooperation towards resource acquisition (Skyrms, 2004). The chicken game could allow for the understanding of the norms of cowardice and appeasement *between* groups, as found similarly by Bornstein, Budescu, and Zamir (1997).

Glowacki draws on ethnographic data to inform his framework. This is a crucial step in research which is not always present. Long-term ethnographic fieldwork can inform the design of games such as the prisoner's dilemma, and help define the parameters set out in the models used to determine whether peace can be achieved. Ethnographic research exploring such factors as resource allocation, decision making, and most importantly the specific cultural norms which are alleged to facilitate and uphold peaceful interactions are needed to enable researchers to design more appropriate games and set more accurate parameters in the models. Several researchers have included community-situated research to achieve this (Henrich et al., 2005; Pisor et al., 2020) but these efforts could be strengthened by incorporating longer-term ethnography and collaboration with social anthropologists, who typically have more training and experience pertaining to gaining insider perspectives, and conducting research in a more explorative, less hypothesis-driven manner, which could reveal less well-studied aspects of societies which affect how their members cooperate.

Additionally, following Henrich et al. (2005), researchers could play games such as the prisoner's dilemma with their interlocutors, while learning about not just their choices but the context and meaning given to those choices by the players. This would give more strength and accuracy to interpretations of the choices made, and link back into improving the design of both the games and models. Ethnographic research can also be utilised in designing versions of games which are more understandable by the players (Henrich et al., 2005, 2006), which may reduce the likelihood that players take actions which appear to support or undermine theory based on misinterpretations of how the game works (Bayer, Renner, & Sausgruber, 2012), rather than the accuracy of the theory.

Altogether if these proposals are employed and their findings align with the predictions and theories Glowacki draws on, this would strengthen the validity of the concepts put forward, providing more substantial empirical evidence to support them. Game theory and ethnography can be used together to understand how people evolved to live peacefully.

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The role of religion in the evolution of peace

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Abstract

Glowacki's account overlooks the role of religion in the regulation of cooperation, tolerance, and peace values. We interrogate three premises of Glowacki's argument and suggest that approaching religion as an adaptive system reveals how religious commitments and practices likely had a more substantial impact on the evolution of peace and conflict than currently presumed.

We agree with Glowacki that concentrating on tolerance and cultural technologies is helpful to understand and support the conditions of peace. In our own research, we too have found that

human communities struggle to create peace but are capable of strategic violence (e.g., Kiper & Sosis, 2021), leaving us with questions about the evolution of peacemaking and conflict prevention. Notably, what is the role of religion in the evolution of peace? Glowacki suggests that a crucial step in peacemaking in early human prehistory was when small-scale societies started using religion as a form of cultural knowledge – beliefs, values, and customs – to enable positive group interactions. We agree that religion likely facilitated cooperation among early human communities, but it also likely encouraged conflict (Alcorta & Sosis, 2022). Here, we take a closer look at the role of religion in the evolution of peace and assess three premises in Glowacki's argument.

Religion and intergroup interactions

According to Glowacki, early small-scale societies valued religions as sources of information and understanding. Those communities that interacted with each other to share and gain this knowledge were able to achieve higher fitness benefits from intergroup cooperation than communities that did otherwise. Although there is evidence of extant foragers intermarrying with neighboring pastoralists and agriculturalists, and thus engaging in cultural exchange and learning (Ikeya et al., 2009), the role of religion in these interactions is variable. Oftentimes, the syncretism that facilitates intergroup exchange is the *outcome* rather than the *cause* of that interaction. For instance, many foragers, such as the Aboriginal peoples of Australia, have syncretized their religion with Christianity, but this is a consequence of colonization (e.g., Cox & Possamai, 2016). In these cases, shared religious understanding has facilitated peaceful interactions that we can observe today, but that peace resulted from earlier, violent encounters between colonizers and indigenous communities. On the whole, valuing other religions results from long-standing group contact, rather than functioning as an impetus for it.

Similarly, it is true that some groups use their religion to increase between group interactions and experience higher payoffs than those whose religion centers on increasing within group cooperation. However, this is often not the case. Successful religious communities usually maintain costly rituals *so that* outsiders cannot freeride on their within group cooperation (Shaver & Sosis, 2018). Religious communities with high intra-group cooperation tend to be closed off to others and interact with outsiders in the most neutral way possible, often without invoking religion. In short, the use of religion for positive between group exchanges may be an exception for syncretized, mystical, and modern religious systems. And most religions are used for increasing *within* group cooperation or *positive peace* for the in-group while between group interactions are religiously neutral to prevent conflict or manifest *negative peace* with out-groups. Recognizing these distinctions complicates claims that peace in early human communities resulted from shared religious knowledge.

Group motivations for peace

Glowacki posits that group motivations for peace likely emerged after early human communities experienced shocks to their culture brought about by intergroup violence. We agree but we disagree that these “shocks” only spurred conscientious motivations. Instead, Glowacki's observations support a systems approach,

where negative feedback from raids and revenge cycles led to the cultural evolution of multiple factors contributing to peace, including changes to the religious system itself. Elsewhere we have shown that the religious system is an adaptive complex, comprised of local variants of the core building blocks of any religion, including authorities, meanings, moral obligations, myths, rituals, the sacred, taboos, and supernatural agency beliefs (e.g., Kiper & Sosis, 2020). These serve various psychological and social functions, rendering religion as an adaptive mechanism that can promote cooperation and coordination (Sosis, 2019). The critical factors that allow for adaptivity are feedback. If the population survives and experiences health and reproductive fitness, the religion remains in equilibrium. However, if the population experiences disease, lowered fitness, or death, the adherents enact changes to the religion (for a review, see Purzycki & Sosis, 2022). Therefore, intergroup violence in the form of “shocks” to the system would have initiated changes other than motivations for peace, including alterations to the core building blocks of religion, ranging from newfound roles for authorities to supernatural agency beliefs.

For instance, in communities throughout postconflict regions of the Balkans, shocks to local systems brought about by war contributed to various cultures of transitional justice (Kiper, 2019). But these shocks were not equivalent for all communities. Some reported that the wars were caused by ethnonationalism and thus rejected religion after the wars (Kiper, 2022a). Other communities with (exclusive) sacred lands experienced increased religiosity and greater willingness to renew conflicts, while others without (or with inclusive) sacred lands experienced similar rates of religiosity but less willingness to renew conflicts (Kiper, 2022b).

Modeling war and peace

Glowacki convincingly argues that initiating intergroup violence for personal gain may be individually advantageous but communally detrimental. This creates a security dilemma where individuals may be better off defecting while the entire group benefits more from cooperation. 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” (target article, sect. 2.4, para. 5).

Despite its validity, the conclusion depends on whether cooperative behaviors are predicted by self-interested agents in pairwise interactions. This is unlikely for most human communities, especially prehistorical small-scale societies. For agents would have rarely acted alone but participated in collectives. Shared behaviors would have emerged from these collectives such as religious rituals. In turn, these behaviors would have resulted in considerable diversity between groups, as they adapted to local environments and modified their behavioral strategies. The religious system would have also fostered strong in-group commitments, where individuals may have prioritized the group over individual gains, and even motivating extreme acts of altruism or self-sacrifice. Given that early human communities had religion, as Glowacki acknowledges, group-level behaviors likely transpired that did not resemble the prisoner's dilemma.

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Competing interest. None.

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Peace is a form of cooperation, and so are the cultural technologies which make peace possible

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Abstract

While necessary parts of the puzzle, cultural technologies are insufficient to explain peace. They are a form of second-order cooperation – a cooperative interaction designed to incentivize first-order cooperation. We propose an explanation for peace-making cultural technologies, and therefore peace, based on the reputational incentives for second-order cooperation.

This is an insightful analysis of the evolution of peace, using the lens of game theory. We propose to complement it, by exposing the cooperative dilemma underlying peacemaking cultural

technologies. While necessary parts of the puzzle, cultural technologies are insufficient to explain peace – they replace one cooperative dilemma with another. We propose a solution based on prosocial reputation. Cultural technologies, such as informal leadership, may be designed to amplify reputational incentives – in which case they replace a difficult cooperative dilemma with one which is easier. This is not just theoretical nitpicking. Taken together, the author's account and our complement can generate testable predictions regarding the conditions under which peacemaking cultural technologies, and therefore peace, may evolve.

As the author rightfully points out, peace is the solution to a cooperative dilemma. In small-scale societies as well as in decentralized urban gangs, war, like defection, exacts a toll on the entire group; yet it is beneficial for certain individuals. If nothing keeps these individuals in check, war is the only Nash equilibrium.

Implicit in this account however, is that peace cannot be explained by reputation – or other canonical explanations for cooperation, such as kin altruism (Hamilton, 1963) and reciprocity (Axelrod & Hamilton, 1981). In the iterated prisoner's dilemma that the author considers, cooperation is a Nash equilibrium when the benefit of a prosocial reputation exceeds the temptation to cheat (Nowak & Sigmund, 1998; Panchanathan & Boyd, 2003). War ends up being the only Nash equilibrium because certain individuals find it beneficial to cheat *even* when considering the reputational cost of deviating from peaceful behavior. In other words, peace can be characterized as the solution to a *hard-to-solve* cooperative dilemma – a cooperative dilemma for which reputation provides insufficient incentives.

To achieve peace, humans need to create additional incentives. The author rightfully insists on the central role played by cultural technologies – norms, social structures, mechanisms, and institutions, which change the underlying incentive structure (Henrich & Muthukrishna, 2021; North, 1991; Ostrom, 1990; Powers, Van Schaik, & Lehmann, 2016). Humans rely on cultural technology to change the rules of the game, and invent peace. To quote the author, peace becomes a possible solution when “decentralized societies begin to develop internal social structures, including age or status groups, or informal but powerful leadership” (target article, sect. 4, para. 2).

Yet, the author does not mention that cultural technologies are themselves the solution to a cooperative dilemma. Age, status groups, and informal leaders need not necessarily work toward the objectives of the group. Instead, they can advance their own objectives. As the author acknowledges, even though they often promote cooperation within the group (Garfield, Syme, & Hagen, 2020), for example, by working toward peace (Fry et al., 2021; Glowacki & Gonc, 2013), informal leaders sometimes use their power and influence to promote their self-interest at the expense of the collective (Singh, Wrangham, & Glowacki, 2017).

Cultural technologies are a form of *second-order cooperation* – a cooperative interaction aimed at promoting cooperation (Ostrom, 1990; Persson, Rothstein, & Teorell, 2013; Yamagishi, 1986). In and of themselves, they are insufficient to explain peace. Cultural technologies allow humans to solve the first-order cooperative dilemma. Yet, they introduce another, second-order cooperative dilemma in its place. It seems we are back to square one.

Our solution is to view cultural technologies as technologies specifically designed to leverage reputation. Cultural technologies need not lead us back to our starting point, because second-order

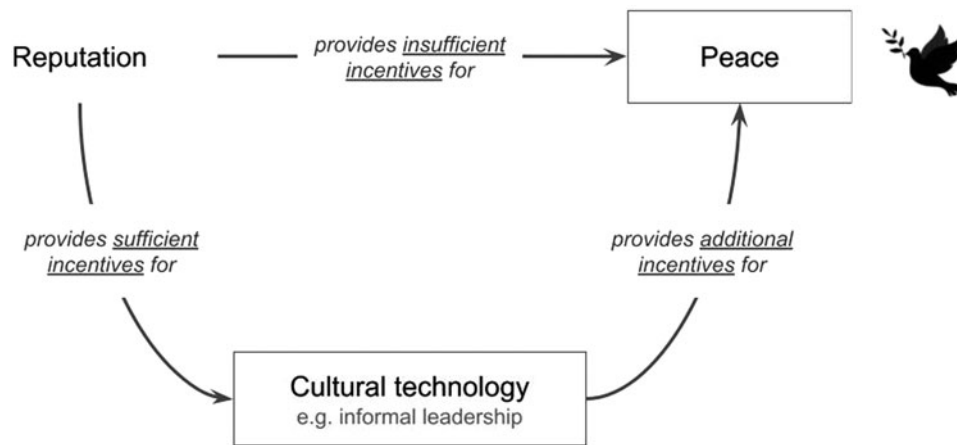


Figure 1 (Lie-Panis and André). An explanation for peace through cultural technology.

cooperation need not be as hard-to-solve as first-order cooperation. Humans can design cultural technologies which: (i) provide sufficient incentives for the hard-to-solve cooperative dilemma, and (ii) are themselves underlain by an *easy-to-solve* cooperative dilemma, that *can* be stabilized by reputation. When this is the case, cultural technologies (and reputation) can explain peace (see Fig. 1).

Informal leaders, for instance, seem decidedly incentivized by reputation. Across small-scale societies, leadership is associated with social status and prestige (Garfield et al., 2021). Leaders tend to enjoy high-social capital (Glowacki & von Rueden, 2015), and high-social and material benefits (Garfield et al., 2020; Gurven, Allen-Arave, Hill, & Hurtado, 2000; Sugiyama, 2004; von Rueden, 2014). Leaders have a lot to lose by defecting. If they cheat, and promote self-serving warfare at the expense of the collective, they stand to lose their very position, and all its accompanying benefits.

In line with the author’s account, there is nothing specific about peace or peacemaking cultural technologies. Cultural technologies allow humans to scale up cooperation – beyond the limited scope of what can be achieved with reputation alone. Our complement further clarifies the “ironic” logic of peace uncovered by the author. Peace with another group is just one instance of large-scale cooperation. War along that group against another coalition is another such instance. Both depend on the ability to stabilize cultural technologies, that is to solve a second-order cooperative dilemma.

We can derive testable predictions from this idea. Cooperation is not infinitely scalable, because second-order cooperation cannot be made infinitely cheap and still provide sufficient incentives for first-order cooperation. We expect higher ability to establish peacemaking cultural technologies, and therefore peace, when individuals have a stronger incentive to invest in their prosocial reputation – for example, in long-standing communities, in which the shadow of the future looms large (Axelrod & Hamilton, 1981; Ostrom, 1990), or in contexts of material security, in which individual’s immediate needs are already met (Lie-Panis & André, 2022; Mell, Baumard, & André, 2021).

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The intertwined nature of peace and war

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Abstract

Glowacki discusses how humans regularly face collective action problems that may result in either peaceful or aggressive between-group interactions. Peace and war probably coevolved in humans. Using a gene–culture evolutionary framework is a powerful way to analyse why, when, and how humans have the capacity to build and maintain long-term peaceful interactions between groups and also to wage deadly wars.

The history of research on peace and war (broadly used here to describe aggressive between-group interactions) is full of debates, mainly related to whether humans are inherently peaceful or violent and to whether evolutionary or cultural forces shape our behaviour (e.g., Fry, 2013; Majolo, 2019). Researchers have often investigated the causes and consequences of war, but sometimes neglected to focus on peaceful interactions. However, there is a growing literature on the evolutionary, socioecological, and cultural factors shaping the maintenance and restoration of peaceful interactions between groups (e.g., Pisor & Surbeck, 2019). Glowacki provides a detailed critical evaluation of the challenges humans face when they attempt to maintain or restore peace. Below I critically evaluate four main points that emerge from Glowacki's study, in relation to the existing literature on the topic.

The first point is that the integration of genetic and cultural evolution into a unified theory (Henrich & McElreath, 2003; Laland et al., 2015) is leading to the progressive abandonment, at least in the biology-grounded disciplines, of the old-fashioned, erroneous dichotomy between genetic and cultural drivers of human behaviour. However, some clarifications are still necessary. It is time to stop using the gene versus culture approach and to start focusing on how genetic evolution can drive cultural diversification, and vice versa, an approach that has been successfully used in several studies (e.g., lactose digestion: Holden & Mace, 2009). Moreover, using evolutionary explanations to describe a behaviour rarely means that that behaviour is innate, fixed, or always displayed; it means that there is an evolved propensity to display that behaviour under specific socioecological conditions. Clearly, something as complex as peace (or war) cannot be described by a set of fixed, innate responses that do not consider the socioecological challenges that an individual or group face. At the same time, humans have to regularly cope with collective action problems and prisoner's dilemma scenarios (Maynard Smith, 1982): These can be addressed via group-specific rituals and norms, but the challenges they pose are universal and our responses to them are likely rooted in our evolutionary history. Analyses that integrate our evolved propensity to solve these

challenges with the emergence and design of norms and rituals that can maintain peace are a more powerful way to explain human behaviour than putting genetic evolution and cultural forces in contrast to one another.

The second point is that peace cannot simply be described by the lack of war, but it requires the evolution and emergence of cultural practices that maintain tolerance and cooperation, reduce the risk of escalation of conflicts of interest, and restore peace when violence is unavoidable. Kim and Kissel (2018) define these practices “peacefare.” Glowacki's study goes in this direction, when he effectively highlights how game theory can explain the challenges of restoring or maintaining peace. The recognition that peace requires the active solution of collective action problems and not “just” the avoidance of war is important, because it highlights that similar socioecological challenges can be solved either peacefully or aggressively. Humans faced both genetic and cultural evolutionary pressure to peacefully solve collective action problems.

The third point is that peace and war are intertwined phenomena. Peaceful and aggressive interactions between groups can sometimes be mutually exclusive to one another, in time or space. However, they may also occur simultaneously; for example, in modern warfare it is common for two countries to organise peace talks while they are still fighting each other. Moreover, pro-social behaviours that aim to maintain peace and cooperation can be extremely violent. Altruistic punishment may result in the killing of free-riders. Similarly, capital punishment of the most violent members of a group is often an effective way to restore peace and break the chain of reciprocal revenge that may “lock” two groups into a long-term period of conflict (target article). Various authors have suggested that peace and war coevolved (e.g., Bowles, 2009; target article). Indeed, humans have to cope with collective action problems both when they try to maintain peace and when they wage war. Shared intentionality, theory of mind, and our capacity for large-scale cooperation and for keeping track of resources exchanged with other individuals/groups, are some of the key cognitive and behavioural traits that can be effectively used to maintain a long period of peace between two groups or to wage a deadly war against our enemies. As Glowacki effectively points out, the intertwined nature of peace and war means that attempts to determine whether humans are inherently peaceful or violent are futile, because we, as a species, are a combination of both.

The fourth point is that an in-depth investigation of the origin, causes, and consequences of peace and war should be a collegial effort: It cannot be undertaken by a single discipline or without comparing different study populations or species. For example, the diversity, across human societies, of socioecological conditions, rituals, and norms leading to peace and war (Fry, 2013; target article) requires an integration of anthropology, ethnography, and psychology with gene–culture evolution, in order to explain the sources of such diversity. Glowacki argues that the main evolutionary changes, that led to the way modern humans maintain peace, wage war, and tackle collective action problems, occurred relatively recently in our evolutionary past (i.e., in the last 300,000 years). Consequently, he mainly focuses on prestate and modern human societies. While this approach has merit, it should not discourage researchers from comparing how humans and other species tackle collective action problems related to cooperation or violence. Such comparative work should not simply focus on the two extant, most closely related species to humans (chimpanzees and bonobos), but it should include other primates,

mammals, and birds to better identify the evolution of key cognitive and behavioural transitions affecting peace and war (e.g., Gómez, Verdú, & González-Megías, 2021). The often claimed uniqueness of humans (e.g., in terms of capacity of large-scale cooperation or of waging deadly wars) rests on the assumption that we have a deep knowledge of the behaviour of other animal taxa.

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Group-structured cultural selection can explain both war and peace

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Abstract

Glowacki recognizes the importance of norms in enabling war and peace, but does not focus on the cultural evolutionary mechanisms by which these norms are maintained. We highlight how group-structured cultural selection shapes the scale and nature of peaceful intergroup interactions. The mechanistic perspective reveals that there are many more cases of peaceful intergroup relations than the current account implies.

More than a million people occupy an area of roughly 68,000 km² in the semiarid savanna of northwest Kenya and practice mobile pastoralism by keeping cattle, camel, sheep, goats, and donkeys. They are divided into 18 distinct social groups each comprising several thousand people. Each group has its own territory within which group members freely graze their animals. Crucially, despite the ubiquity of firearms and the individual benefits that Glowacki emphasizes could be had by raiding, there is peace among these groups. As defined in the target article: They have ongoing interactions marked by infrequent violence with harmonious relationships not enforced by the threat of (intergroup) violence. In fact, there is rampant intermarriage and trade between these groups, negotiations frequently occur between elders of these groups to share grazing areas during the dry season, and most conflicts that arise between individuals from different groups are resolved without violence.

These groups are different *ngitela*, geographically defined social divisions of the Turkana. While there are persistent peaceful relations among the *ngitela*, there are also norms and institutions that promote warfare. In the part of Turkana where we do our research, about half of adult male mortality is due to intergroup combat (Mathew & Boyd, 2011), and about 40% of male participants have visible bullet scars from combat (Zefferman & Mathew, 2021). Norms reward the killing of out-group members, especially men and boys (Zefferman & Mathew, 2020). What explains this seeming contradiction? While there is peace between Turkana *ngitela*, there is often war between Turkana and neighboring ethnolinguistic groups, such as the Toposa. There are norms and cultural institutions that promote peace at one level of organization and norms that promote war at another. It is hard to discuss war and peace without discussing the levels of organization at which these happen.

There is also a seeming contradiction at the heart of the target article. Glowacki proposes that peace is a prisoner's dilemma where warfare results in private gains to the participant, but the costs are shared widely by the participant's group. This is different from the usual assumption that war is the dilemma with costs borne by individuals and benefits accrued to the group. One gets the impression from the article that peace is the *real* dilemma or at least a coequal one to war. In Glowacki's framing, groups must invent cultural institutions and norms that promote peace as opposed to war to overcome war's private benefits. However, the private benefits to the individual, as Glowacki frames them, are themselves the result of cultural institutions and norms to promote warfare – specifically norms that reward warriors and punish cowards. Additionally, the group costs are themselves the result of norms that promote escalatory tit-for-tat revenge. In short, to the extent that peace is a collective action problem at all, it is because societies have culturally evolved norms that solve the collective action problem of war! To attain peace, why not just drop the war-promoting norms instead of inventing new contradictory norms? The target article does not explain this contradiction.

We do not disagree with much of the target article's thesis. However, we think that (1) it exogenizes the evolution of some norms (those that promote war) while endogenizing others (those that promote peace); (2) it is ambivalent about defining the social scale of groups and at what levels of organization we should expect more intragroup conflict or intergroup cooperation; and (3) it does not identify a mechanistic process for the patterning of war and peace.

We have argued (Zefferman & Mathew, 2015) that group-structured cultural selection can help clarify the diverse forms

of intergroup relations in humans, and provides a mechanism for the evolution of both war and peace. In brief, rather than a war-oriented psychology or a peace-oriented psychology, humans have a norm psychology, a propensity to recognize and adopt the cultural norms of one's local group. Norms allow cultural adaptation to novel local circumstances much faster than genes alone would. These adaptive forces maintain between-group variation in norms at multiple social scales. Norms that increase the success of their adherents will spread at the expense of less successful ones. When group-level interactions are strong, norms that benefit the group over the individual will be favored.

Group-structured cultural selection can yield war or peace based on which norms lead to the success of a group under local circumstances. If a group's success increases more by trading and intermarrying with their neighbors than by looting or killing them, those norms spread, amalgamating different social groups under a normative umbrella that supports social order at a larger scale. If it increases more by raiding and warfare, then norms encouraging raiding and warfare will spread. Most societies have a mix of norms where war is context dependent – dictating when, how, and with whom it is appropriate or inappropriate to have war or peace. If so, when should we expect to see peace, and when should we expect war? Group-structured cultural selection predicts that warfare will tend to occur along social boundaries in which cultural differentiation occurs and peace will tend to occur along social boundaries where there is little cultural differentiation. This is exactly what Handley and Mathew (2020) document in the pastoral populations of northwest Kenya. Norms promote helping across social boundaries that are culturally similar and promote raiding across social boundaries that are culturally dissimilar.

The recognition that norm psychology is crucial to understanding war and peace in humans also helps resolve Glowacki's question about when peace evolved. To the extent that peace is a collective action problem solved by social norm enforcement, it likely evolved at the same time as our norm psychology – and ironically – at the same time we developed the capacity to invent norms for war. Knowing the propensities of our distant common ancestor with chimpanzees and bonobos would not be too informative. As we have previously argued (Zefferman & Mathew, 2015), “if primordial propensities for war or peace exist, they seem to be quite readily overwhelmed by local cultural norms.”

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On the evolved psychological mechanisms that make peace and reconciliation between groups possible

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Abstract

If group norms and decisions foster peace, then understanding how norms and decisions arise becomes important. Here, we suggest that neither norms nor other forms of group-based decision making (such as offering restitution) can be adequately understood without simultaneously considering (i) what individual psychologies are doing and (ii) the dynamics these psychologies produce when interacting with each other.

One of the great challenges for successful consilience in the social sciences is knowing when and where methodological individualism – exemplified by characterizing subpersonal psychological mechanisms (i.e., cognitive adaptations) – starts and stops. Even if you knew every synapse, fiber, and Rube Goldberg convolution of functional specialization housed within individual skulls, you still would not understand the complex dynamics that play out when individual minds start interacting.

Complicating matters, a lot of computational machinery is precisely for social dynamics, baked into our minds courtesy of natural selection. Because social life emerges from interacting minds possessing adaptive machinery for life in groups, it is possible to overestimate the role of the evolved psychology while simultaneously underestimating the complexity of that evolved psychology.

In the target article, Glowacki points to group norms (e.g., punishing individuals who raid out-groups) and group decisions (e.g., paying restitution to victimized out-groups) as factors that foster peace. But noting such factors is different from understanding how they arise. To do that, we contend, requires (i) unpacking the complexity of the underlying psychological mechanisms involved, including describing what is being represented and acted upon within individual minds, and (ii) unpacking the complexity of the social dynamics created by these individual minds in interaction with one another. In turn, we suggest that “group” decisions and norms are not themselves psychological mechanisms, but rather strange and fragile outcomes, arising from individual psychologies having already vied and interacted with one another.

We also seek to avoid analyses that may fall prey to “instinct blindness.” The psychological mechanisms that parse the world

into social groups operate so effortlessly that we might fail to recognize that they exist at all (Cosmides & Tooby, 1994). Even something as seemingly simple as perceiving individuals as members of in-groups and out-groups poses formidable computational challenges. These are in part solved by mechanisms that represent simpler three-person interactions – including (a) who you are willing to harm after you have harmed me, (b) who is willing to harm you after you have harmed me, (c) who is willing to harm me after you have harmed me, and (d) who I am willing to harm after you have harmed me – all of which are then used to infer (or better still, project) group membership onto individual agents (Pietraszewski, 2022).

Acknowledging the complex dynamics underwritten by these and other representational systems may help us to better understand why restitution encourages peace after intergroup raids. In dyadic interaction, there is no mystery: The offender pays a cost now to advertise that they will be paid back these short-term costs by restoring a productive relationship and avoiding (potentially much steeper) retaliatory costs (McCullough, Kurzban, & Tabak, 2013). But this reasoning does not scale up to the intergroup level because not all group members have the same incentives. For instance, suppose I did not participate in the raid: Why should I be willing to concede that the raid was “our fault?” And if I am in the victimized group, why should I expect that restitution from those who did not participate in the raid is even relevant?

The reason, we suggest, has to do with concerns about the future. To the extent that raiders in pursuit of spoils kill randomly, and that raids motivated by revenge against specific people can easily draw in the targets’ family members and allies, each person in group V (“V” for victim) is right to assume that they are as likely to be killed in a future raid as anyone else. They are therefore better off representing that the attack that just killed “some people I sometimes fish with” was actually an attack against all of us; our “group.” And this is why the narrative becomes “Group A attacked us” (“A” for attacker) rather than “some random people who live over there attacked a bunch of people over here.”

We can also consider things from the perspective of individuals in group A: If they want to predict the future, they will need to represent how group V is framing the raid. Because members of group V are unlikely to know which members of group A actually conducted the raid, they will hold all of the people in group A culpable (for the reasons above). Consequently, group A’s members can safely infer that members of group V will view the *members of group A as interchangeable*.

Even so, some in group A have an incentive to resist this framing. Raiders might be inclined to accept the group framing in order to dilute their individual culpability, while nonraiders might be inclined to reject it. Likewise, those who would be called upon to make restitution (in the form of money, weapons, cows, daughters, or sons) are more likely to resist the group framing than those who lack anything to make restitution with. The individuals within these subgroups can come into conflict as they deliberate about whether to provide restitution: Their costs and benefits differ. So, they in turn must be able to represent additional group or alliance dynamics within their group as they try to convince others about what they should do. Eventually, the subgroups of individuals within group A who resist the “We raided you” framing must be either convinced to change their minds or coerced into going with the flow by those who support it.

The point, then, is that a norm to maintain positive ties or make restitution, or a group “decision” to do so, is a social dynamic above and beyond the individual psychologies; it is already the *outcome* of individual psychologies vying for their particular interests.

One final note: We (along with the individuals who make up our hypothetical groups A and V) have indulged the idea that groups A and V objectively exist. But they do not. Groups do not exist in the same way that rocks exist; they are “useful delusions” that help agents coordinate action in the service of cooperation and conflict (Tooby & Cosmides, 2010, p. 206). Group identities are promissory notes, built atop hopes of future cooperation and fears of future conflict.

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Enhanced cooperation increases the capacity for conflict

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Abstract

Enhanced cooperation increases the capacity for humans to engage in large-scale warfare. This ability provides the foundation for male coalitional behavior, leaving open the question of whether cooperation evolved in the same way, or for the same purpose, in females. Such coalitional behavior entrains hierarchical forms of leadership that remain inherently unstable, providing a spark for conflict to emerge.

Peace may be an invention designed to optimize the benefits of long-term cooperation, as Glowacki argues. Yet cooperation first served a more influential purpose. The ability to cooperate solved the repeated evolutionary challenge of fighting off predators whether environmental, animal, or human. These forms of

cooperation facilitated and encouraged greater capacity to wage large-scale warfare. In short, humans learned to cooperate in order to engage in combat more effectively.

This cooperation rests on a foundation of male coalitionary behavior (Wrangham, 1999). Such coalitions entrain hierarchical forms of leadership that remain inherently unstable, as each member continually vies for higher status within the group, providing a spark for intragroup conflict to emerge continually. The role of leadership in suppressing intragroup conflict while simultaneously facilitating more effective intergroup conflict is crucial in scaling arguments derived from more egalitarian societies to larger scale modern nation states.

The interconnection between the capacity for cooperation and conflict offers insight into how the evolution of peace, based on small-scale societies, can be scaled to a more generalized argument applicable to large modern nation states. This argument faces at least three important challenges.

First, extrapolating from small-scale societies to large states requires consideration of the incentives and constraints inherent in large institutions and organizations. What applies to small-scale societies may not hold within the context of large bureaucracies that are driven/mediated by processes at odds with basic human psychological architecture. Specifically, once the militarized threshold is crossed in combat, and weapons help neutralize the importance of physical strength and formidability, the risk and benefits associated with combat are changed. Physically smaller men can kill large numbers of physically stronger people with precision weapons. Given the importance of the role of leadership in hierarchical societies, followers need to be convinced that leaders have their best interests, and those of community, in mind when committing to war. Followers need to believe the risks they undertake are worth the prize they expect. In small-scale societies, keeping track of how benefits are distributed is easier. But is not clear if the selection pressures that operate on small-scale societies function in the same way in the context of large-scale state-sponsored conflicts. This limits the generalizability of the argument regarding incentives and capacity for stable peace in the context of modern large-scale societies.

Second, the argument for peace laid out in the target article deals primarily with the capacity for intergroup cooperation with little discussion of the challenges of maintaining in-group harmony and cooperation. Leadership hierarchies are inherently unstable. But violence within large-scale societies is no longer rare, unexpected, or quickly resolved, as suggested in this article. Rather, it remains endemic. One need only look at the enormous number of mass casualties from gun violence in the United States or the repression of ethnic minorities like the Uyghurs in China or the Rohingya in Myanmar to question the limits of peace and cooperation within large-scale societies.

Third, kin-based clan governance styles have been shown to produce dysfunctional and unstable patterns of state behavior, including decreased security (Hudson, Bowen, & Nielsen, 2015). These dynamics of state behavior rely on extreme subordination of women, often through discriminatory family law practices. The current policies of the Taliban in Afghanistan provide a vividly heartbreaking example of these strategies. The destructive influence of clan-based governance models demonstrates the significance and implications of sex differences in aggression for large state stability and security (Hudson, Caprioli, McDermott, & Bowen, 2023; McDermott, 2015). The inherent instability of

the hierarchical governance models upon which male coalitions depend opens the question of whether cooperation, or conflict, evolved in the same way, or for the same purpose, in females. One need not argue that women are inherently peaceful to recognize that women may choose to fight under different circumstances, and for different reasons, than men. For example, women have been shown to be more likely to join defensive, as opposed to offensive campaigns (Lopez, 2017).

Humans are not inherently either peaceful or bellicose by default. Rather, we have the capacity for cooperation to engage in both. An integrated and productive approach seeks to examine the conditions and circumstances under which both aggression and cooperation might have emerged and proved beneficial and productive for men and women, in different ways and for varied reasons. This allows the discussion to move beyond an entrenched either-or approach and encourages for a more nuanced understanding of human evolution. Appreciating the inherent adaptability of individuals also generates novel hypotheses regarding the potential for modern nation states to structure their institutions and bureaucracies in ways that are in more natural alignment with human cognitive architecture. Biology does not act in isolation; rather, various programs can be activated by different environment and social circumstances. For example, hierarchical leadership structures create incentives for conflict, but also constraints on the ability to overthrow the leader. Recognizing how these various structures offer opportunities and impose limits on human affiliation and aggression can provide insight into how best to build future institutions to encourage cooperation and diminish hostility. Evolution may have exerted selection pressures that allowed for the development of cooperation and the socially integrated norms mentioned in the target article. But evolution also exerted pressures that generated incentives for violence against those who pose threats or risks.

If peace is an invention, it is one that needs more work. It remains a distant dream not only in history but also in modern international relations. The current war in Ukraine stands as testament to how one man aspiring to preeminence can wreak havoc on many great nations seeking to thwart his desire for supremacy. An evolutionary lens provides insight into how humans might do a better job at overcoming internecine conflict in order to achieve more cooperation with less hostility, but also cautions humility in our ability to overcome our inherent drives and desires for dominance.


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The psychology of intergroup relations was grounded in intragroup processes

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Abstract

Although Glowacki proposed that peace developed from the relatively recent advent of intergroup norms and tolerance for out-group members, we submit that (a) positive intergroup relations developed from a psychology grounded in the regulation of intragroup relations, (b) the “default” intergroup orientation is uncertainty, and (c) positive intergroup relations likely existed early in our evolutionary history.

Glowacki provides an interesting account regarding the conditions necessary for peaceful intergroup relations. On a behavioral level, the account makes sense, but it falls short when describing the underlying psychological processes. Glowacki submits that the key to peace is the ability to predict the behaviors of both in-group and out-group members, a process that is facilitated by the presence of group-level norms. However, this explanation omits processes critical to understanding the origin of peaceful intergroup relations.

One account for the development of human sociality is that positive intergroup relations developed from the processes that governed intragroup processes. Indeed, numerous theorists, beginning with Darwin (1859, 1871), have proposed that the challenges associated with regulating interactions with other persons were preeminent in guiding the development of the hominid psyche (e.g., Alexander & Noonan, 1979; Bigelow, 1969; Hamilton, 1975; Humphrey, 1976; Wilson, 1973). The origins of the psychology of intragroup relations likely had their roots in simpler inter-individual relationships. Starting with the first facilitative bipeds and the ability to gather, transport, and accrue resources (e.g., last common ancestor; *Ardipithecus ramidus*; 5.8–5.2 million years ago; WoldeGabriel et al., 2009), the social structure changed to include sharing and cofeeding (Belisle & Chapais, 2001). These changes fueled the growth of males’ monopolization of access to females, and the physical proximity led males to spend more time with them (and her offspring) to adopt a stabilizing reproductive strategy (Grueter, Chapais, & Zinner, 2012). Parent–offspring and offspring–parent recognition and investment stemmed from this intimate and sustained parental care (Chapais, 2008; Lieberman, Tooby, & Cosmides, 2007). The psychology that governs intragroup relations – which at its most basic form suggests that kin should consider first the interests of fellow kin – was borne from the relatively basic processes related to kin-formation, including motherhood, fatherhood, sib-lingship, incest avoidance, and in-law recognition (e.g., Hill & Hurtado, 2009; Korchmaros & Kenny, 2001; Lieberman, 2009).

Early hominids extended these pair-bond-like relationships beyond breeding couples to develop relationships in wider social networks (Aureli et al., 2008). Thus, the intergroup norms that Glowacki describes as critical are important, but they are of secondary importance relative to the underlying psychological process bearing on intragroup processes.

A critical implication of an intergroup psychology derived from intragroup processes is that the “default” intergroup dynamic is uncertainty rather than the aggression/conflict. Laboratory research into intergroup relations reveals that conflict is strongly rooted in uncertainty or fear of the out-group (Wildschut, Pinter, Vevea, Insko, & Schopler, 2003). In the context of mixed motive game (i.e., the prisoner’s dilemma; Luce & Raiffa, 1957), interactions that include a safe, “withdrawal” option – in addition to the usual cooperative and competitive choices – groups prefer to withdraw to competing (Schopler et al., 1993, 1995). Indeed, when there is uncertainty about what the out-group will do, in-groups cooperate less with them (Insko, Kirchner, Pinter, Efav, & Wildschut, 2005).

Groups avoid conflict – and even seek peace – when given the opportunity. Laboratory variations using “minimal” groups (Tajfel, Billig, Bundy, & Flament, 1971) show that when group members allocate resources to the in-group and out-group, they divide money equally between them (Bornstein et al., 1983; Gaertner & Insko, 2001). And when in-group and out-group evaluations are made separately, participants prefer bolstering the in-group over harming the out-group (e.g., Brewer, 1999; Brewer & Campbell, 1976). When participants are tasked with allocating painful noise, they favor equal distributions to ones that predominantly hurt the out-group (e.g., Mummendey et al., 1992).

Such intergroup interactions reflect motivations grounded in an intragroup psychology. Many theorists, including those focusing on social identity (Tajfel, 1970; Tajfel & Turner, 1986) and on in-group favoring norms (Montoya & Pinter, 2016; Montoya & Pittinsky, 2013) emphasize that intergroup motivations are fueled by normative pressure to favor the in-group. For instance, group members behave cooperatively or competitively with an out-group according to the group norm that was emphasized to them (Jetten, Spears, & Manstead, 1996; Montoya & Pittinsky, 2013). As noted by Glowacki, there are a number of pressures that can push intergroup relations to be hostile. For instance, conflict is more likely when in-group members overtly support hostilities (Wildschut, Insko, & Gaertner, 2002) and when individual group member’s behaviors are concealed from the out-group (Schopler et al., 1995), to name but two.

Uncertainty permits a range of potential intergroup interactions, including ones that are positive. But as we have noted, the potential for intergroup peace is dependent on the concerns of the in-group.

The possibility of peace – and the advantages of positive intergroup relations – likely began early in human evolutionary history. The growing complexity of human’s social relationships is reflected in a dramatic increase in encephalization that began approximately 4–6 million years ago (Grabowski, 2016; Van Schaik, Triki, Bshary, & Heldstab, 2021). The primary factor for the growth in brain size in hominids (controlling for body mass) has been attributed to the problems associated with the complexity of social relationships (including alloparenting, coalition formation, tactical deception; Dunbar & Shultz, 2007; Isler & Van Schaik, 2006). Indeed, cooperative intergroup relations were essential for survival, and their benefits that started earlier than 300,000 years ago. The degree of outbreeding identified by

studies of genetic diversity (e.g., Workman & Niswander, 1970) cannot be explained solely by competitive strategies (e.g., taking slaves after victory). Cooperative intergroup relations (which include group merging or emigration) were necessary not only to avoid inbreeding, but also to create groups that served needs relative to the food supply and mating (Knauff et al., 1991; Loehle, 1995).

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The evolution of (intergroup) peace hinges on how we define groups and peace

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Abstract

Glowacki defines peace as harmonious relationships between groups maintained without the threat of violence, where groups can be anything from families to nation states. However, defining such contentious concepts like “peace” and “groups” is a difficult task, and we discuss the implications of Glowacki’s definitions for understanding intergroup relationships and their evolutionary history.

In his target article, Glowacki provides a thorough and even-handed review of the ethnographic and archaeological records of intergroup conflict and peace, especially in small-scale nonstate societies, underscoring the flexibility of human sociality. Glowacki defines peace as an active (rather than passive) dyadic relationship between two groups, which can include everything from family units to nation states, built on top of intergroup tolerance (Pisor & Surbeck, 2019), trade and specialization (Fearon & Laitin, 1996; target article, sect. 3.2, para. 2; sect. 3.2.1, para. 1), or the organization of motivated leaders (Olson, 1965). By making his definitions of peace and groups explicit, Glowacki has helped us better explore the challenges scholars of human sociality face when discussing these topics.

Glowacki is clear that pacification (per Helbling, 2006) is not peace, a point of tension in the larger literature, stating that peace is “the expectation and presence of generally harmonious relationships *not enforced with the threat of violence*” (emphasis added; target article, sect. 1.1, para. 5). In essence, he makes the case that when internal, within-group threat of violence enforces harmonious relationships, that counts as peace, but when external threat of violence enforces harmonious relationships, it does not. This is in contrast to Glowacki’s treatment of war, where he chooses not to distinguish internal and external warfare – even though he states that “the cultural tools that allow us to develop peaceful relationships are the very same ones that allow us to sometimes engage in total war” (target article, sect. 1, para. 5). His distinction between internal enforcement of peace and external enforcement of pacification is somewhat inconsistent with his treatment of state societies, where he notes that state societies can facilitate peace in nonstate small-scale societies by introducing physical punishment and execution – threats of violence – among other externally imposed institutions. This then raises the question of when nonstate small-scale societies pacified by states count as a *different* group from that state society, meaning they are subservient to the state and the relationship between the two is not peaceful, versus the *same* group as the state society, meaning they are merely in-group members encouraged to be peaceful through threat of violence. Similarly, if a subgroup within a society is dissatisfied and protests or rebels, how severe must the sanctions be before maintaining peace becomes pacification? In short, perhaps differentiating internal peace from external pacification is useful, but the issue of which relationships counts as peaceful and which do not should be further specified, especially as it interacts with how we distinguish between intra- and intergroup relations.

What constitutes a “group” also raises key questions about the timing of when peace emerges in our evolutionary history. Glowacki emphasizes the increased importance of intergroup peace in the late Pleistocene, a point on which we agree (Pisor & Ross, 2022), but de-emphasizes peace-building around the time of the origins of *Homo* (~2 million years ago). Glowacki defines social groups as ranging from families and

kin groups to nation states. While the question of what constitutes a group in humans is contentious (see Moya, 2022; Pietraszewski, 2022, for relevant discussion), we largely agree with this inclusive definition. But if units as small as families or bands constitute groups, then peaceful intergroup relationships were likely fostered by exogamy long before the late Pleistocene – for example, around the origins of *Homo* (Chapais, 2008). However, Glowacki’s focus on conflicts between societies, rather than between family units or bands, leads him to conclude that intergroup peace did not emerge until the late Pleistocene. For example, Glowacki argues that “prior to 700,000 years ago, there is little evidence that our hominin ancestors engaged in or would have needed to engage in intergroup cooperation” (target article, sect. 6, para. 2). However, intermarriage between kin groups was likely a powerful source of intergroup tolerance and alliances – and we view the latter as cooperation. In short, with such an inclusive definition of groups, human social organization in early *Homo* would have facilitated intergroup peace even if the products of this cooperation did not fossilize (e.g., Kramer, 2023; Pisor & Surbeck, 2019; Rodseth & Wrangham, 2004). Arguments of the timing of different events in the evolution of sociality necessarily hinge on definitions of peace and groups.

Glowacki’s target article is a *tour de force*, synthesizing multiple fields of study and offering a more even-handed treatment of peace and flexibility in intergroup relationships than the existing literature. By making many assumptions explicit, he presents a fruitful avenue for future research on war and peace. Of course, making assumptions explicit makes them easier to critique and reflect upon. Here, we reflected upon two of his assumptions: The distinction between pacification and peace, and a seeming disconnect in the definition and treatment of groups. These have implications for the stories we tell about the evolutionary history of intergroup relationships. It behooves researchers of human sociality to revisit their assumptions about human sociality (e.g., Glowacki, 2023b; Kramer, 2023; Moya, 2022; Pietraszewski, 2022; Pisor & Ross, 2022, 2023) as it can inform where the field is headed next. Glowacki’s article accentuates areas of overlap between evolutionary anthropology and other social sciences and will further advance interdisciplinary research on the flexibility of human peace.

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Social norms, mentalising, and common knowledge, in making peace and war

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Abstract

The emergence of social norms would have been dependent on the evolution of the cognitive capacity for mentalising to multiple orders of intentionality. Common knowledge is a related phenomenon that can solve coordination problems. That the same cognitive and social mechanisms should facilitate both peace and war is resonant with Girard's scapegoat hypothesis on the relationship between violence and religion.

Glowacki identifies social norms as having played an important role in the emergence of both peace and war. Arguably, the emergence of such social norms, and hence of peace and of war, would have been dependent on the cognitive capacity for higher order mentalising, and the role played by this in conflict management merits further consideration.

Dunbar (2014) describes a uniquely human cognitive ability to mentalise to multiple orders of intentionality, with one order being self-awareness, second order the ability to infer the mental state of another, third order the ability to infer another's inferences about another's mental state, and so on, with most adult humans being capable of mentalising to between four and five orders (Launay et al., 2015). Although focussing more on the origins of religion and group cohesion, rather than social norms and conflict, Dunbar argues that a cognitive capacity for five orders of intentionality makes possible complex storytelling, enabling the emergence of religion and shared sets of beliefs with a common world view.

A related phenomenon is that of common knowledge (Lewis, 2008) which has been described as a type of recursive mentalising (De Freitas, Thomas, DeScioli, & Pinker, 2019), whereby "I know X, and I know that everyone else knows X, and I know that

everyone else knows that everyone else knows X," and so on. As this is limited to just one piece of information, it is less cognitively demanding than the complex storytelling described by Dunbar, thus enabling what are, in effect, infinite orders. Common knowledge can solve coordination problems, including the cooperative dilemmas described by Glowacki, involving conflict suppression and conflict initiation.

However, common knowledge alone neither necessarily entails any moral duty nor imperative, to act in a particular way. Two hypotheses that do, at least implicitly, entail common knowledge about moral imperatives in the context of conflict, are DeScioli and Kurzban's hypothesis on the evolutionary origins of nonconsequentialist morality (DeScioli & Kurzban, 2013), and René Girard's scapegoat hypothesis on the origins of religion (Girard, 1986).

Nonconsequentialist, or deontological, moral thinking is ubiquitous in humans, but as it involves moral imperatives that are independent of outcome, these can often seem maladaptive. DeScioli and Kurzban (2013) consider the evolutionary origins of such potentially harmful moral cognitions. They surmise a role in allowing individuals to coordinate which side to take in a conflict, thus making conflicts more decisive and limited, rather than delicately balanced, protracted, and costly. This coordination function relies on there being common knowledge as to what the relevant deontological moral code is, which is, arguably, akin to a social norm.

Girard (1977) speculated that humans are unique in having an unconscious tendency to mimic, or imitate, one another's mental states (a phenomenon he called mimesis). Arguably, this was an emergent property of a cognitive ability to mentalise having developed where there was a preexisting tendency to imitate behaviours, as when a conspecific's mental state can be inferred, it can also be imitated. Although this may have conferred an adaptive advantage in aligning all members of a community towards a common goal, analogous to Tomasello's concept of shared intentionality (Tomasello & Carpenter, 2007), Girard argued that this would also have been socially destabilising by undermining hierarchical differences, and generating rivalries, as everyone imitated each other's desires. This, he suggested, was one of the main causes of early hominin conflict, or intragroup conflict at least. His scapegoat hypothesis (Girard, 1986; Riordan, 2021) posits that such conflict would have been countered by a phenomenon which would itself have been an emergent property of imitation, that is, a tendency to respond to crises, including conflict-related crises, by imitating the blaming of an often arbitrarily selected victim, culminating in their expulsion, or more likely, their killing by mob violence. He suggested that such spontaneous, violent and cathartic events had strong unifying, and thus coordinating effects on communities, and were the origin of mythological, religious, and by extension moral, narratives, as archaic communities may have, post hoc, misidentified the victim as God-like, perceiving them to have both caused and resolved the crisis.

Lewis (2008) proposes three means by which common knowledge can be generated: Precedent, agreement, and salience. As agreement requires some preexisting system of communication, arguably, only salience can initiate common knowledge de novo. Although Girard did not explicitly refer to the concept of common knowledge per se, the very public, unanimous, and emotionally charged behaviour he envisaged may have provided early human societies with the salience required to generate common knowledge de novo, especially common knowledge about sacred or deontological values and the associated social norms.

I argue that Dunbar's religious narratives that enhance group cohesion, DeScioli and Kurzban's nonconsequentialist moral

cognitions that mitigate conflict, and Girard's scapegoat mechanism that generates unanimous sacred values, although distinct hypotheses, with different emphases, have, nevertheless, much in common, and may be describing what is essentially the same phenomenon. That is, the emergence of common knowledge making possible social norms, including, importantly, those social norms, considered by Glowacki, that manage and coordinate peace and war.

Glowacki's observation that the social and cognitive mechanisms that bring peace, can also be used to wage war, is resonant with Girard's posited mechanism that entails violence bringing about peace, as both illustrate the ambiguity between the sources of peace and of war. Common knowledge may have provided not only the means for making peace and war, by solving coordination problems, but also the motivation, by making possible shared deontological or sacred moral imperatives.

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Is peace a human phenomenon?

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Abstract

Peace is a hallmark of human societies. However, certain ant species engage in long-term intergroup resource sharing, which is remarkably similar to peace among human groups. We discuss how individual and group payoff distributions are affected by kinship, dispersal, and age structure; the challenges of diagnosing peace; and the benefits of comparing convergent complex behaviours in disparate taxa.

Peace depends on the precarious balance between the shared benefits it brings to a whole community, and what an individual may gain from disrupting that peace. Glowacki provides an elegant explanation for the origin of peace between human groups, and why the conditions tipping this balance in favour of peace are rare. Peace, that is, long-lasting positive-sum intergroup relationships, is unknown among other mammal species, even those capable of short-term intergroup cooperation (Connor, Krützen, Allen, Sherwin, & King, 2022; Fruth & Hohmann, 2018), and yet, peace is not a uniquely human phenomenon. Certain ant species engage in long-term, nonaggressive, mutual resource exchange between nests (Burns et al., 2020; Robinson, 2014; Robinson & Barker, 2017). Indeed, both ants and humans display the full range of intergroup behaviours, from extreme hostility to remarkable harmony (Pisor & Surbeck, 2019; Rodrigues, Barker, & Robinson, 2022). This raises intriguing questions about why peace arises in these two ecologically and taxonomically distinct groups.

Glowacki's model of differing payoffs for individuals and groups provides a compelling framework for considering the emergence and maintenance of peace in humans (target article, sect. 2). This framework is generalizable to ants: In ant colonies consisting of close kin, the payoffs are more homogenous, because workers gain from successful conflicts only through benefits to their queen. This interdependence relaxes the tension between the individual-level and group-level benefits (Rodrigues et al., 2022). Where within-group relatedness is relatively low, "policing" is a potential mechanism, in both humans and ants, repressing the competitive tendencies of belligerent individuals. In social insects, policing is typically associated with multiple-mating and the concomitant decrease in within-group relatedness (Foster & Ratnieks, 2000; Liebig, Peeters, & Hölldobler, 1999). Among humans, there is suggestive evidence for a similar association between policing and lower within-group relatedness (Kümmerli, 2011). Moreover, kinship between groups means that asymmetric payoffs need not compromise intergroup cooperation, and may even favour between-group altruism (Pisor & Surbeck, 2019; Rodrigues et al., 2022).

Spatial context shapes intergroup relationships: Within human societies, group isolation can lead to peace, while the presence of neighbours promotes conflict (target article, sect. 1.1). The relationship between geographical distance and the potential for peace becomes more complex when we make explicit the dynamics of groups: Both the value of resources and the risk of conflict with kin are higher when interacting with near neighbours (Taylor, 1992). In the simplest scenario, these effects cancel each other out, and thus geographical distance does not have a straightforward effect on intergroup relationships (Rodrigues et al., 2022). Between-group movement changes the payoff distributions by inflating between-group relatedness. In some contexts, this raises the cost of intergroup conflict due to the increased risk

of harm to kin, which promotes the maintenance of peaceful local intergroup interactions, especially during conflict with other unfamiliar groups (Rodrigues, Barker, & Robinson, 2023).

Across societies, proclivity for warfare differs among group members (Glowacki & McDermott, 2022), often with older members attempting to curb younger members' higher inclination towards conflict (target article, sect. 3.3). Social insects also show age-related behaviour, but in contrast, riskier tasks, including fighting, are typically undertaken by older individuals (Cammaerts-Tricot, 1975; Robinson, 1987; Uematsu, Kutsukake, Fukatsu, Shimada, & Shibao, 2010). The key difference here lies in the individual-level age-dependent costs and benefits (Rodrigues, 2018). Among humans, a younger male's fairly low risk of injury during intergroup raids is outweighed by the benefits of acquiring additional resources and/or reputation, despite the community-level costs arising from the loss of peace and subsequent likelihood of retaliatory raids. Older individuals may face a greater risk of injury, and stand to gain less from accruing additional resources or reputation, particularly after they have already reproduced (target article, sect. 2). Among social insects, workers' reproductive potential is highest when young; even in societies with reproductive division of labour, young workers often have active ovaries (Page & Peng, 2001). Young workers thus incur individual costs if killed in intercolony conflicts, whereas older workers have no potential for direct fitness through reproduction, and therefore their behaviour is driven solely by the inclusive-fitness benefits of group defence. At the group level, the mode of group formation strongly affects group composition and cohesion over time. In ants that exhibit intergroup cooperation, groups founded by a few individuals split into networks of related interconnected nests, whereas in humans, both group formation and development are more fluid. Thus, age-specific individual-level payoffs differ in humans and ants, and a group's demographic composition may have a species-specific influence on the emergence of peace.

Peace is more than simply the absence of war (target article, sects. 1, 3 and 7). In human societies, we have cultural information that helps us distinguish peaceful coexistence from fearful avoidance, although both might result in superficially similar behaviours (Pisor & Surbeck, 2019). Among nonhuman animal groups, conflict avoidance is a major behavioural driver (Morris-Drake, Kennedy, Braga Goncalves, & Radford, 2022; Rodrigues et al., 2022; Triki, Daughters, & De Dreu, 2022) and many apparent examples of intergroup tolerance may be the product of ongoing active conflict reduction. Although we are currently limited to identifying peaceful outcomes rather than peaceful intentions in nonhuman animals, evidence is accumulating for the cognitive complexity of social insects, including emotion-like states in bees that are consistent with those in vertebrates, measured behaviourally and chemically (Chittka & Rossi, 2022). As methods of measurement continue to become more sophisticated, we may get closer to determining the mental states of nonhuman animals during peaceful interactions.

Parallels between human sociocultural evolution and comparable processes in social insects provide an opportunity to relinquish an anthropocentric perspective and identify the essence of a behavioural phenomenon (DeSilva, Traniello, Claxton, & Fannin, 2021; Gowdy & Krall, 2013; Robinson & Barker, 2017). Some similarities between ants and human societies are likely due to the emergent properties of complex social systems, irrespective of the nature of their component parts, others are due to an intriguing convergence, where similar endpoints are reached

through differing evolutionary mechanisms. Such convergent examples offer the opportunity to identify necessary and sufficient steps and alternative pathways to a given endpoint. The occurrence of long-lasting, positive-sum, interdependent intergroup relationships in both humans and ants has the potential to provide new insights into the evolution of peace.

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Peace as prerequisite rather than consequence of cooperation

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Abstract

We take issue with Glowacki’s assumption that intergroup relations are characterized by positive-sum interactions and suggest to include negative-sum interactions, and between-group independence. As such, peace may be better defined as the absence of negative-sum interactions. Rather than being a consequence of cooperation, peace emerges as a necessary but not sufficient prerequisite for positive (in)direct reciprocity between groups that, in turn, is key to social identities and cultural complexity.

In the fascinating article, Glowacki proposes that peace can be understood as the solution to iterated prisoner’s dilemma interactions between members of different groups. Following a game-theoretic approach and a systematic review of conflict in small-scale societies, Glowacki concludes that peace is a consequence of cultural complexity, and that in turn cultural complexity has been favored by the formation of social identities within groups. Here, we take issue with (i) the conceptualization of intergroup relations as solely characterized by positive-sum interactions, and (ii) the lack of attention to how bottom-up processes such as direct and indirect reciprocity can lead to the formation and dissolution of groups, group identities, and institutions.

Glowacki starts from the assumption that intergroup relations are characterized by positive-sum interactions. While it is true that humans possess remarkable abilities to cooperate within and between groups, interdependencies between groups can range from negative-sum to positive-sum interdependencies, or reflect independent coexistence (De Dreu & Gross, 2019; De Dreu, Gross, Fariña, & Ma, 2020; Deutsch, 1973). For example, how groups relate to each other depends on (changes in) socioecological systems, resource scarcities, and subsistence style (De Dreu, Gross, & Reddmann, 2022). And different interdependencies dramatically shape and change intergroup interactions (De

Dreu et al., 2020). While peaceful coexistence is by definition present between independent groups and possible in positive-sum environments (Romano et al., 2021; Romano, Gross, & De Dreu, 2022a). Rather than defining peace as the solution to problems of cooperation, peace can be more parsimoniously defined as lack of conflict – something possible in any type of interdependence among groups. Crucially, however, the presence of peace neither translates into the establishment of cooperation, nor does a lack of cooperation translate to the presence of conflict. Rather than a consequence, peace becomes a necessary but not sufficient prerequisite for intergroup cooperation.

When peace is defined as the absence of conflict, there is no need to hypothesize that the mechanisms evolved to establish peace between groups evolved after the mechanisms that sustain cooperation. In fact, humans evolved strategies to cope with different interdependencies, including strategies to avoid conflict in negative- and zero-sum interactions (Aktipis et al., 2018; Balliet, Tybur, & Van Lange, 2016). This is not to say that cultural complexity does not contribute to the current features of peace that, for example, characterize international relations in the modern world. It is to say, however, that the psychological mechanisms that can bring groups of individuals to abstain from conflict can have coevolved in parallel to and independent of the psychological mechanisms that foster cooperation.

Acknowledging and integrating the interdependence structure of intergroup relations help to understand when and why cultural complexity may actually foster conflict rather than peace. Indeed, Glowacki makes the interesting observation that cultural complexity is often associated with an increased ability of groups to act unanimously, by developing, for example, hierarchies, role differentiation, and a dedicated military class. In environments in which groups are locked in negative-sum relationships, the ability of groups to coerce their members to act together may actually increase the likelihood of conflict and its associated waste (De Dreu et al., 2016).

In the final analysis, the question remains how groups move from peaceful coexistence to cooperation and, perhaps group fusion and fission. One possible answer is suggested in work on direct and indirect reciprocity (De Dreu, Fariña, Gross, & Romano, 2021; Lehmann, Powers, & Van Schaik, 2022; Romano, Balliet, & Wu, 2017; Romano, Saral, & Wu, 2022b; Wu, Balliet, & Van Lange, 2016; Yamagishi & Kiyonari, 2000). When initial acts of cooperation are reciprocated and rewarded rather than exploited, cooperation can become sustainable both within and between groups. Indeed, recent simulations and experimental studies in our laboratory revealed how more frequent interactions between members of different groups promote the emergence of cooperation across group boundaries and the creation of public goods that connect groups (Gross et al., 2023). Importantly, frequent intergroup interactions also led members to start identifying more with a larger collective rather than their own group – social identification is an emergent property rather than a causal mechanism for group formation and intergroup cooperation. With more (frequent) intergroup exchanges, reciprocity permeates group boundaries and fosters the fusion of groups, resulting in larger, multilayered groups with complex institutions.

Taken together, we suggest, in line with extant work on cooperation and conflict within and between groups, to define peace as the absence of conflict and (in)direct reciprocity as key to building cooperative relations between groups. For intergroup cooperation

and fusion to happen and cultural complexity to emerge, we need peace and (in)direct reciprocity.

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Police for peace

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Abstract

Glowacki's detailed account of small-scale societies' endogenously emerging tendencies to oscillate between phases of peace and war highlights a need for understanding better the incentives governing "internal" policing for "external" peace-keeping. Here, I sketch some of these incentives and point out a resulting dilemma which Glowacki's account leaves unresolved for the time being.

In his target article, Glowacki provides a detailed discussion of dynamics of conflict emergence and mechanisms for conflict resolution within and between small-scale nonstate societies. The analytical angle he chooses for his account is progressive: Instead of searching for causes of conflict in either the relations between groups, for example, their competition for dominance in a given region, or in their shared environment, for example, food scarcity caused by climatic instabilities, Glowacki takes a detailed look at drivers of conflict within societies themselves.

Thus, instead of treating groups as monadic units with potentially clashing interests between them but internally aligned goal functions, Glowacki breaks groups down into several classes of individuals, each with agendas of their own. This approach obviously complicates the analysis. However, as demonstrated in the target article, it also facilitates new insights. Our understanding of large-scale modern-day conflicts has benefited a lot from similar analytical refinements – see for example, Esteban, Morelli, and Rohner (2015); Esteban and Ray (2011); for an overview, see Rusch (2022). Moreover, within the domain of microlevel research on individuals' conflict behavior the study of heterogeneous incentives within groups has also gained traction – see for example, for humans: Doğan, Glowacki, and Rusch (2018); Herbst, Konrad, and Morath (2015); Kölle (2022); Konrad and Morath (2022); and for nonhuman animals: Johnstone, Cant, Cram, and Thompson (2020); Radford (2011).

The key troublemakers Glowacki identifies in the societies he discusses are young men. In his account, these benefit quite directly from the raids they organize, often without the consent of their group, while not having to fear high direct costs thanks to the stealth and surprise tactics they employ. However, the attacks carried out by a few raiders then have detrimental consequences for their groups at large, as retributive strikes are carried out by out-group avengers indiscriminately against all members of the raiders' group. In essence, this is a situation of privatized benefits for those thrill-seeking violent young men and socialized costs borne by their entire group. Theoretically, thus, those who suffer from these externalities should be willing to take action against the raiders within their own group as long as the costs of such "policing" are smaller than the losses incurred due to raiding. In short: There can be positive incentives to "police for peace."

Indeed, Glowacki describes such behavior: The existence of norms against raiding and their enforcement via sanctions in some societies fit very well with this reasoning. Moreover, supporting the structural argument, civil police forces take over important roles in peacekeeping also today – see, for example, Greener (2011) and Mailhot, Kriner, and Karim (2022). However, policing for peace faces several obstacles. For one, violent young men are difficult to police, a problem that has not been solved well in contemporary state societies either – see, for example, Freeman (1996). Where policing is too costly, thus, it might in fact be better, from a group-level collective perspective,

to let this subgroup's aggressive potential be acted out as violence against out-groups compared to letting it manifest internally – a logic also found in modern warfare, see, for example, McKay (2021). Second, while policing for peace might prevent detrimental spirals of aggression and counteraggression from unfolding between groups, it is, of course, subject to the same dilemmatic logic like peacekeeping more generally. It is likely worth the costs only in case the respective out-groups go along and manage to curb their male youth as well.

Some support for this view comes from Glowacki's observation that contact with states often had pacifying effects on previously feuding small-scale societies. Representatives of these states might have introduced and enforced exactly that type of policing which endogenously could not be established due to the mentioned dilemma. This, however, also raises the question of how those states themselves, or their predecessors, initially managed to resolve the policing dilemma, of course. Glowacki's target article leaves this question unanswered and, given the lack of robust evidence available to answer it, this is wise. Nonetheless, at least one developmental scenario occurs as deserving some more thought to me, that of the "peacelord."

Picking up Glowacki's dissecting approach, the young men of a society are not a homogeneous mass themselves. They have an internal hierarchy, too. The individual at the top of this hierarchy, their "leader," likely has some degree of control over those in lower ranks, see Glowacki and McDermott (2022) and Glowacki and von Rueden (2015). A diplomatically talented leader, thus, could capitalize on this by playing a dual role: He could police "his men" to avoid uncontrolled outbreaks of violence, thus acting as a "peacelord." Simultaneously, he could steer his followers' aggressive potential in ways balancing their demand for "thrill" with the interests of his group at large, thus acting as a "principled warlord." Of course, such balancing still requires occasional conflicts with selected out-groups. Their overall consequences might be less devastating relative to uncontrolled all-out war, though.

I would expect that reliable evidence for the "peacelord" scenario will be hard to come by. Nonetheless, at least some first plausibility maybe be conferred to it from observations collected by Blattman, Duncan, Lessing, and Tobón (2021): In their analysis of organized crime in the Colombian city of Medellín they find, initially quite counterintuitively, that gang rule can be as effective as state rule in the production of stability and protection for citizens there. Structurally, thus, their observations are well aligned with the "peacelord" idea. In the absence of effective law enforcement, young men endogenously organize into gangs which enforce their monopoly on violence within their territories, thus creating a degree of public safety. Between gangs and larger strategic alliances of such, on the contrary, episodes of violence alternate with phases of "power balance" and relative tranquility. On a structural level, thus, Blattman and colleagues report patterns with striking similarities to those described by Glowacki for small-scale societies.

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Rethinking peace from a bonobo perspective

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Abstract

Reconstructing pathways to human peace can be hampered by superficial evaluations of similar processes in nonhuman species. A deeper understanding of bonobo social systems allows us to reevaluate the preconditions for peace to gain a greater insight on the evolutionary timescale of peace emergence.

Glowacki provides a unique perspective on the evolutionary foundations of human peace – carefully evaluating how harmonious relationships between groups can arise, and the conditions required to maintain a peaceful status quo. In a synthesis of human and nonhuman ethnography and game theory, his work generates novel hypotheses on the emergence of human peacemaking. The crux of Glowacki's argument is that humans did not evolve an innate capacity for peace but have rather developed unique cultural mechanisms to maintain positive-sum relationships between groups. Providing a detailed and careful consideration of the interplay between the mechanisms leading to conflict and peacemaking, Glowacki's framework lays the groundwork for testable novel hypotheses. However, we argue that a more accurate representation of the social systems and between-group dynamics of broader taxa is needed before we can reconstruct potential pathways to peace and understand the processes leading to human's remarkable societies.

Glowacki defines peace through two parallel processes: The expectation of harmonious relationships between groups and the overall rarity of expression of aggression and violence. When violence does occur, it is expected to be quickly resolved. Following this definition, it is clear why the presence of cooperative relationships between groups is not a sufficient condition for peace. However, whether the absence of war and violence between regularly interacting groups is a sufficient determinant of peaceful relationships remains unclear. Between-group tolerance in the absence of violence is commonly observed in nonhumans. Taxa as varied as primates, elephants, and cetaceans (Grueter, Chapais, & Zinner, 2012; Nandini, Keerthipriya, & Vidya, 2018; Schreier & Swedell, 2009; Stead & Teichroeb, 2019; Whitehead et al., 2012) live in multilevel societies where distinct groups separate and merge across time and space to maximize the benefits of social living. In these societies, violence is rare and between-group tolerance provides clear benefits to participating social units that would not otherwise be conferred (Grueter et al., 2020). What can these social systems teach us about pathways to peace? Must conflict occur and be resolved for us to identify peace in a society? At the minimum, the between-group connections and rarity of conflict in these systems permit the investigations of diverging evolutionary trajectories that lead to similar outcomes – tolerant systems that support information flow and exchange.

One may argue, however, that it is unclear how group identities play out in multilevel systems. If individuals perceive everyone as in-group, such systems will be disqualified as examples for the presence of peace because peace can only be defined as a between-group currency. Here, bonobos (*Pan paniscus*), one of our closest living relatives, offer valuable insights into a system of between-group tolerance among socially and culturally distinct groups (Samuni, Langergraber, & Surbeck, 2022; Samuni, Wegdell, & Surbeck, 2020). Bonobos live in large, male-philopatric groups that regularly interact. Members of different groups forage and hunt together (Lucchesi et al., 2020; Sakamaki, Ryu, Toda, Tokuyama, & Furuichi, 2018; Samuni et al., 2020), jointly mob predators (Samuni & Surbeck, unpublished data), support one another in conflict (Tokuyama, Sakamaki, & Furuichi, 2019), and even share meat and other high-quality foods (Fruth & Hohmann, 2018). The remarkable between-group cooperation that bonobos exhibit among non-kin is only second to humans (Samuni & Surbeck, unpublished data).

Bonobo cross-group interactions are not always tolerant or cooperative, and aggression and nonlethal violence are part of the repertoire of bonobo between-group interactions (Cheng,

Samuni, Lucchesi, Deschner, & Surbeck, 2022; Tokuyama et al., 2019). In fact, the perception that physical aggression commonly occurs when bonobo groups meet has led Glowacki to argue that humans are alone in establishing and maintaining peace. But how frequent or violent should aggression be to be considered common enough to disqualify peace in bonobos? For such a critical determinant of the evolutionary timescale of peace emergence, Glowacki fails to offer objective measures by which the presence of peace in our closest living relatives can be quantified, thereby subjectively (and prematurely) discounting the bonobo as a taxon with likely homologous capacity for peace.

Like humans, bonobo populations show large variation in the amount of time that different groups spend together and the quality of these interactions – from rare and largely aggressive between-group interactions in LuiKotale (Hohmann & Fruth, 2002) to prolonged and predominantly tolerant interactions in Wamba (Tokuyama et al., 2019) and Kokolopori (Lucchesi et al., 2020). Variation in between-group interactions is also evident within bonobo populations, with some groups spending days and weeks together while others only rarely meet (Samuni, Langergraber, & Surbeck, 2022). Here, we focus on behavior between bonobo groups that exhibit prolonged and frequent interactions, the type of connections relevant for discussions on peace.

When bonobo groups meet, disputes that can escalate into physical aggression and injuries may occur. Nonetheless, bonobo between-group aggressions are typically short, include mild threats or displays without any physical contact, are quickly resolved, and are not known to escalate into severe injuries. While the rates and intensity of aggressions tend to increase when bonobo groups meet, this heightened aggressive behavior is directed similarly toward out-group and in-group individuals (Cheng et al., 2021, 2022; Tokuyama et al., 2019). This is the key point – bonobo aggression between groups is similar to within-group expressions of aggression and does not resemble the levels of between-group violence observed in humans or in their sister species chimpanzees (*Pan troglodytes*) (Wilson et al., 2014; Wrangham, 2018; Wrangham & Glowacki, 2012). Therefore, bonobo aggressive tendencies toward out-groups occur at a sustainable level that is not expected to precipitate a breakdown of relationships between those groups. Despite having the same social structure thought to promote proactive violence and warfare in humans and chimpanzees, bonobo between-group violence is greatly reduced. This suggests the presence of mechanisms that foster bonobo between-group tolerance and cooperation, while restraining destructive conflict.

Reconsidering the bonobo as a species that can maintain peaceful between-group relationships requires a rethinking of the preconditions of peace and the evolutionary timescale of peace emergence. Variation in the expressions of violence and tolerance across bonobo populations offers a practical avenue for investigating the mechanisms underlying peaceful capacities in human-adjacent societies. How can bonobos maintain peace in the absence of social norms or institutional control? In humans and chimpanzees, expressions of proactive aggression are closely linked with their extreme tendencies for between-group violence (Wrangham, 2018). Proactive aggression, however, is greatly reduced in bonobos (Wrangham, 2018). Following Glowacki's rationale – that the factors promoting destructive violence in humans are also the ones contributing to the emergence of peace – we suggest that it is the lack of extreme violence in bonobos that enables “simpler” solutions to peace without relying on norm psychology or culture.

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Cultural technologies for peace may have shaped our social cognition

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Abstract

Peace, the article shows, is achieved by culturally evolved institutions that incentivize positive-sum relationships. We propose that this insight has important consequences for the design of human social cognition. Cues that signal the existence of such institutions should play a prominent role in detecting group membership. We show how this accounts for previous findings and suggest avenues for future research.

Peace, as this article reminds us, is nothing but a particular manifestation of a more general ability of humans to reap the benefits of mutually beneficial exchange – often called positive-sum relationships – instead of engaging in the war of all against all. Perhaps the most fundamental insight to be gained from this article is that the extent of this ability is supported by a highly complex culturally evolved system of institutions that incentivize cooperation by a great diversity of means. Cultural technologies like age-sets, peace ceremonies, efficient monitoring systems, or trading rituals are all highly complex, require very high levels of coordination, and typically emerge as a result of a long history of cultural accumulation over time (Alvard, 2003; Wiessner, 2019; Wiessner & Tumu, 1998). In this commentary, we propose to extend the author's insight by highlighting how it can fit within the existing literature in social cognition and contribute further to this field.

Indeed, from an evolutionary perspective, the great variability in the ability of humans to achieve positive-sum relationships – that is, they sometimes achieve peace, but often cannot escape war – creates a selective pressure for an *alliance detection system* designed to keep track of the social relationships that structure one's particular social landscape. This includes both positive-sum relationships – for instance, the detection of friendships and coalitional alliances – and zero-sum ones – for instance, the detection of rivals or enemies (Lieberman, Kinzler, & Woodward, 2014; Pietraszewski, Cosmides, & Tooby, 2014; Pietraszewski, Curry, Petersen, Cosmides, & Tooby, 2015).

This system is, of course, sensitive to direct evidence of positive-sum relationships, such as when people can directly observe instances of cooperation between individuals (Chalik & Rhodes, 2014; Kurzban, Tooby, & Cosmides, 2001; Liberman & Shaw, 2017, 2018). But, importantly, it also pays attention to *indirect* cues that are good predictors of social relationships: For instance, sharing goals, intentions, preferences, accents, or adhesion to norms can all facilitate cooperation and are indeed interpreted by human social cognition as predictors of social relationships (Basyouni & Parkinson, 2022; Kinzler, 2021; Liberman & Shaw, 2017, 2018; Liberman, Woodward, & Kinzler, 2017; Liberman, Kinzler, & Woodward, 2021; Liberman et al., 2014; Noyes & Dunham, 2017; Wilson, Bassiou, Denli, Dolan, & Watson, 2018).

The insight that culturally evolved technologies are fundamental to stabilize positive-sum relationships thus has the potential to make a substantial contribution to the field of social cognition.

Cultural technologies are not just abstract constructions that humans make, they should also constitute a major input for detecting group membership and cooperative networks in their environment. Observable cues suggesting that a group of individuals is embedded in a set of well-functioning institutions should trigger the alliance detection system and be encoded as a predictor of positive-sum relationships within the group.

This idea resonates with an already consistent body of evidence in the behavioral and political sciences suggesting that shared institutions play a fundamental role in group behavior (Bowles & Gintis, 2004). Indeed, numerous lab experiments suggest that impartial and efficient sanctioning institutions can significantly increase social trust and prosocial behavior (Cassar, d'Adda, & Grosjean, 2014; Fabbri, 2022; Hruschka et al., 2014; Spadaro, Gangl, Van Prooijen, Van Lange, & Mosso, 2020). Critically for the author's perspective, fair and effective institutions can even suppress prejudice between two rival groups (Bartoš & Lively, 2021; Cassar et al., 2014; Fabbri, 2022; Lin & Packer, 2017; Van Bavel & Packer, 2021). Such institutions are usually operationalized as abstract entities that punish cheaters in lab experiments, or as state-like institutions in field studies. However, as Glowacki notes, institutions that favor the sanctioning of free-riders can take a wide variety of cultural forms – including much less formal ones. One important institutional strategy to stabilize cooperation is that societies tend to structure social networks in a way that facilitates the monitoring and sanctioning of cheaters, notably by encouraging the circulation of reputational information (Hechter, 1987; Ostrom, 1990). In line with this idea, an influential field study in Uganda showed that ethnic preferences are merely a reflection of the belief in shared and efficient sanctioning institutions – typically through dense social networks that facilitate the detection of free-riders (Habyarimana, Humphreys, Posner, & Weinstein, 2007; see also Bartoš & Lively, 2021, for a similar result in Afghanistan).

We invite researchers in social cognition to view this target article as an invitation to extend this line of research. More empirical work is needed to investigate how the presence of certain shared features – such as the presence of strong leaders, the existence of shared rituals, and other forms of cultural arrangements identified by Glowacki and others – can be used as cues by our social cognition to infer cooperative networks in our environment. This question is especially interesting when investigated from a “third-party” perspective (see, for instance, Noyes & Dunham, 2020). For instance, are groups with effective leaders or with an institutionalized tradition of peace ceremonies perceived as more cohesive than groups without these features? Understanding how the perception of cultural technologies affects the way humans construct group boundaries has two important consequences.

First, it can contribute to understanding some peculiar cultural phenomena, such as why people often seem to take pride in the ancient roots of their culture (for illustrations of this tendency in modern nationalism, see Hobsbawm & Ranger, 1983). One answer may be that the ancient cultural history of a group signals that it has had the time to craft highly complex cultural technologies over the course of generations. A group that can claim ancient cultural roots may be perceived as having institutions that are better at solving the coordination and cooperation problems inherent in human social life, and thus at stabilizing positive-sum relationships.

Second, it can better guide the policy recommendations for peacebuilding. As noted by the author, many peacebuilding initiatives are attempts to create or rejuvenate cultural technologies that

favor reconciliation and cooperation. Focusing on social cognition opens an additional avenue: Peace could be favored by exposing people to reliable cues that they evolve under cultural systems that are effective in resolving social dilemmas. For instance, making punishment, peace ceremonies, or any other functional institution more visible to citizens might considerably increase their willingness to interact peacefully.

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The roots of peace

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Abstract

By focusing on peace, Glowacki provides a fresh perspective on warfare. Why did humans evolve peace? Other animals aggregate peacefully when resources are not economically defensible. The human capacity for peace may arise from two key factors: Multilevel societies and psychology shaped by within-group exchanges, which may have begun when tools enabled hominins to extract foods, including tubers and roots.

While anthropologists have debated the origins and evolution of war extensively, peace remains a neglected topic, and is often simply taken for granted as the situation that would prevail in the absence of war. Glowacki provides a welcome focus on this topic, highlighting the unusual character of peaceful interactions among human groups compared to other animals. Glowacki's field experience with cattle raiders provides important insights into the challenges of maintaining peaceful intergroup relations, given the incentives for individuals to conduct raids or otherwise break the peace. I agree with Glowacki's main points, and focus on two questions: (1) Is human intergroup peace unique? (2) When and why did our ancestors evolve the capacity for intergroup peace?

Glowacki states that “humans are alone in having durable, positive-sum, interdependent relationships across unrelated social groups” (target article, Abstract). Are humans truly alone in this respect? And if so, why?

To answer this question, Glowacki focuses mainly on our two closest living relatives, chimpanzees and bonobos. While studies of these species provide valuable insights, no living species is likely to be a perfect model of our extinct ancestor. Our ape cousins exhibit various traits that appear derived compared to our last common ancestor (Hunt, 2020). Looking more broadly across animals, many species aggregate peacefully: Shoals of fish; flocks of birds; and herds of bison and gelada monkeys. Competition

occurs within these aggregations, but members do not attempt to attack other groups or aggressively exclude outsiders. Such peaceful aggregations can be explained through economics: When resources are dispersed or transient, it is not feasible for any one group to monopolize them (Brown, 1964). Primates tend to defend their home ranges as territories only when it is economical to do so (Mitani & Rodman, 1979). Bonobos may have more peaceful intergroup interactions than chimpanzees because their home ranges are not economically defensible (Pusey, 2022).

As Glowacki notes, peaceful interactions in humans involve not just tolerance, but also positive-sum interactions. Intergroup relations among chimpanzees involve mainly zero-sum games. Apart from immigration by dispersing females, male chimpanzees benefit from intergroup encounters only insofar as they can impose costs on the other group, by deterring them from entering their own territory, forcing rivals to cede territory, and/or killing rivals to reduce their coalition strength (Wilson, 2013). While bonobos sometimes have peaceful intergroup interactions, only rarely do beneficial exchanges such as food sharing occur (Fruth & Hohmann, 2018). Aggregating fish, birds, and grazers may gain mutual benefits, including access to mates, information about food, and increased safety from predators. Humans demonstrate an even greater capacity to engage in mutually beneficial intergroup interaction, shown to an extreme degree by the intensely interconnected global economy, but also discernible among foragers, who exchange trade goods, information, permission to use water holes and hunting grounds, and marriage partners (Kelly, 2013). As Glowacki notes, the first evidence of intergroup trade dates back to around 300,000 years ago. But were these the first such interactions? And why did humans, but not other primates, evolve this capacity?

Glowacki claims that “the preconditions for peace only emerged in the past 100 thousand years” (target article, Abstract). While key cultural tools for building peace likely did arise recently, I propose that the roots of peace extend much deeper than that. At least two key preconditions likely have a long history in hominin evolution: Multilevel social organization and collective foraging, which promotes a psychology of sharing and exchange.

Glowacki notes that humans are “members of multiple social groups simultaneously with overlapping nonexclusive boundaries” (target article, Introduction, para. 3), which makes it difficult to define the boundaries of our groups. As such, our societies resemble the multilevel societies of some monkeys (Grueter, Chapais, & Zinner, 2012; Layton, O'Hara, & Bilsborough, 2012; Swedell & Plummer, 2019). How, why, and when our ancestors evolved multilevel societies remains unknown. The multilevel societies of geladas and hamadryas baboons may depend on two key factors. First, sparse and seasonally variable food supplies prevent individuals from foraging in large groups year-round; instead, in some seasons, individuals must forage in smaller groups. Second, in open habitats, sleeping sites safe from predators are scarce, limited to cliffs and groves of tall trees. Such sleeping sites serve as gathering points for subgroups that disperse throughout the day to forage. Agent-based modeling supports the hypothesis that when females forage in smaller groups, males can sire more offspring by monitoring and monopolizing access to a few females, rather than constantly searching for fertile females in the population at large (Crouse, Miller, & Wilson, 2019). If multilevel societies originated early in human evolution, then the capacity for interacting peacefully across a range of social

groupings would be an ancient trait of hominins (Wilson & Glowacki, 2017).

The psychological capacity for trading goods between groups likely depends upon a long evolutionary history of trade within groups. Hunter-gatherers forage collectively, bringing food back to camp to cook and share with their families and other group members. Psychological traits exhibited even by small children differ profoundly from the more self-centered psychology of nonhuman apes. We are more other-minded, with a greater capacity to control impulses to achieve future goals (Hrdy, 2009; Tomasello, 2014). These psychological traits underpin the collective foraging of hunter-gatherers, and suggest a long evolutionary history of sharing and exchange, going back perhaps to the origins of *Homo*, or even earlier hominins such as *Australopithecus*. Key foods proposed for australopiths include the underground storage organs of plants: Corms, roots, and tubers (Laden & Wrangham, 2005). Simple sticks and stones arguably enabled early hominins to extract hidden and protected foods, including roots, tubers, nuts, marrow, and brains. Such extracted foods potentially enabled foragers to produce a surplus to be shared with others, such as mothers sharing with offspring. Our effort to model the origins of hominin food sharing found that long-term mating bonds between males and females would promote sharing of extracted foods by females to males, so long as males provided females with other benefits, such as protection from predators, infanticide, and theft (Alger, Dridi, Stieglitz, & Wilson, 2023). The roots of intergroup peace in humans may thus originate with a root-based economy.

Competing interest. None.

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Language likely promoted peace before 100,000 ya

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Abstract

Based on evidence of selection against alpha-male behavior in the earliest *Homo sapiens*, I suggest that by 300,000 ya (years ago) language would have been sufficiently sophisticated to contribute to peacemaking between groups. Language also influenced the social landscape of peace and war, and groups' ability to form coalitions.

Glowacki's splendidly integrative and constructive analysis marks an important advance by assessing the evolution of peace and war as an entwined set of responses to competing dilemmas. His overall conclusion that long-term peaceful relationships among human groups must have depended on sophisticated systems of communication and norm enforcement is persuasive. It suggests three topics that could usefully be developed using his conceptual framework.

First, it is plausible that mechanisms for establishing peace between groups emerged earlier than Glowacki's proposal of around 100,000 ya. Glowacki argued that because archaeological evidence of wide-ranging trade networks is meager prior to ~100,000 ya, sustained peace was unlikely to have been enacted before then. In justification of that idea, he proposed that prior to that date, sociocognitive mechanisms would have been inadequate for maintaining peace. In contrast, I suggest such mechanisms would have been available by around 300,000 ya.

My claim is based on the assumption that a critical sociocognitive mechanism for making peace between groups would have been a sophisticated form of language, and that we can reconstruct language as reaching the necessary level prior to 300,000 years ago. The 300,000 ya date comes from the argument that by then, subelite males were conspiring to kill the alpha male. Evidence that they did so derives from domestication-like features in the earliest *Homo sapiens*, which mean that for the first time in our *Homo* lineage, there was then selection against the aggressive behavior that typically confers high fitness on tyrannical alpha males (such as those that characterize all Old World apes and monkeys, including bonobos). Since alpha males are defined by their being able to defeat subordinates in one-on-one interactions, the reduction in aggression-related anatomy is hard to explain unless it resulted from alliances of subelite males coordinating to kill the alpha (Wrangham, 2019).

Nonhumans cannot conspire and therefore cannot plot to kill a resented alpha male (Wrangham, 2021), whereas among humans the conspiratorial killing of excessively violent males is routine and was probably universal in societies without prisons (Boehm, 2012). Communally agreed executions undoubtedly depend on linguistic ability being sufficiently sophisticated to

permit the development of careful plans, while minimizing the risk of being betrayed to the alpha. This suggests that by 300,000 ya, language (and the norms that it fosters) would have been capable of similar dynamics in the context of fostering peace between groups – at least if those groups spoke the same language. Therefore if peace was truly limited before 100,000 ya, as the archaeological evidence hints, the limits on its development should have come from something other than sociocognitive constraints. Here I assume that negotiations about intergroup peace are about as cognitively challenging as negotiations about intragroup conspiratorial killing. Evidence against that idea would undermine the hypothesis that intergroup peace was possible long before 100,000 ya.

Second, the occurrence of peaceful relationships between groups would presumably have been strongly structured by the distribution of different languages or dialects, to the extent that the ethnolinguistic social arrangements of nomadic hunter-gatherers provide a relevant model for *H. sapiens* (Singh & Glowacki, 2021). Residential groups (bands) would typically have been members of a network of groups sharing a common language or dialect, and the entire network would have been neighbored by others using a different language or dialect. Andamanese societies offer a model of this system. On the one hand, “internal war” (i.e., war within a language network) alternated with peace, in a pattern that Glowacki described for small-scale societies in general. On the other, among the 11 Andamanese ethnolinguistic societies a state of “external war” devolved into peace so rarely that war was described by Kelly (2000, pp. 118–119) as “unremitting... a condition of existence that defines the boundaries of the niches exploited by two populations... peace was unattainable in external war” (Wrangham & Glowacki, 2012). Presumably peace would always have been harder to generate as language differences increased.

Theoretical advances on Glowacki’s conclusions could therefore come from a more explicit consideration of how the distribution of language differences among residential groups would have evolved. In this respect a fascinating challenge for archaeology is to distinguish within-society trade from between-society trade. The fact that cultural systems tend to be uniform within but not between societies suggests that a history of the development of ethnolinguistic societies might eventually be discernible.

Third, peaceful relationships among residential groups would have had implications for promoting mutual benefits not only at the dyadic but also the polyadic level. Specifically, peace between two groups would often have allowed them to more effectively make war against a third. This reminds us that one benefit of peace is an alliance that increases both defensive and offensive power, and adds a further context to Glowacki’s demonstration that peace and war have been intimately related to each other throughout their evolution.

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How language and agriculture promote culture- and peace-promoting norms

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Abstract

Humans are predisposed to form in-groups and out-groups that are remarkably flexible in their definition due largely to the complex language that has evolved in them. Language has allowed for the creation of shared “background stories” that can unite people who do not know each other. Second, the discovery of agriculture has resulted in the critical need to negotiate boundaries, a process that can lead to peace (but also war).

The ability to easily form coalitions is critical to establishing peace, but the formations of coalitions create in-groups, and by necessity out-groups. But what holds the coalition together? Aside from simple self-interest, it would be difficult for so many individuals who did not know each other to trust each other. It would help greatly if the groups within the coalition had similar “background stories.” Although physical similarities would be helpful, the ability to communicate easily (language) would be even better, and similarities in beliefs (religion or customs; Dunbar, 2016; Harari, 2015) would be better yet. Certainly, a powerful feature of the human species is our flexibility in defining the characteristics of in-group and out-group. During the World War II, the Germans and Japanese were both hated out-groups, but consider their very rapid transformation shortly after the war to well-accepted members of our in-group. Importantly, this transformation was likely brought about by the emergence of, at least nominally, a once in-group member, Russia, which quickly became a common perceived threat.

For humans, the ability to create stories that define in-group and out-group is critical to both peace and war. These stories often appear to be fixed, yet they are remarkably flexible and can easily change. To create and propagate these stories requires, at a minimum, a well-developed language system.

Thus, what humans have that other animals have only minimally is language, a critical component of culture. Other animals may have precursors of culture, more aptly called traditions (Avital & Jablonka, 2000), but language allows for complex stories to be spread throughout one’s group and typically passed down for generations. A common language allows people who do not

know each other not only to communicate but also to feel that strangers are still members of the in-group.

An important aspect of being human that is not well appreciated is that even if the language of one's group is different from that of another group, being human, one can generally assume that those others speak and understand some form of language, what has been called metalanguage. This is the idea that the sounds that come from the mouth of another person are symbolic representations that stand for objects and ideas that can be learned by pairing those sounds with gestures, pointing to objects, and iconic drawings. Thus, when humans meet, they can have the expectation of being able to communicate not only the emotions that other animals can communicate, but also words – parts of speech that together represent ideas. This ability to learn the language of others has allowed for the myths of one group to spread to many other groups whose languages may differ. The notion that a symbol in one language is likely to have corresponding symbol in another language allows ideas to spread widely. Consider the spread of religions such as Christianity and Islam across groups with quite different customs and languages. Thus, groups that differ widely in other respects can share cultural practices that make them become members of the same in-group. And being members of a common in-group gives them the potential to live peacefully. As Glowacki notes, however, the ability to communicate about one's stories and myths also allows us to disagree about details of those stories, and when other economic or political differences arise, the details of those story may become the focus of cultural disagreements that can turn violent. Consider the conflicts between Catholics and Protestants in Northern Ireland (variations of the same in-group, Christianity).

The norms that Glowacki considers important for large diverse groups to behave peacefully require language and the metalanguage that allows for the translation of stories from one language to another. Having a common story (peace is a good thing) allows diverse groups to agree on norms of behavior. And if peace is a goal, those norms will allow for the possibility of negotiation when there are disagreements (Pinker, 2011).

In the author's model of the development of the motivation for both peace and war, although the primary focus is on hunter-gatherers, it would be strengthened by a greater appreciation of the contribution agriculture has made in the way groups interact. When seminomadic hunter-gatherers were attacked, a ready option would have been to grab their meager belongings and move to a more hospitable location. The loss may have been the resources available in the place that they had been forced to abandon. But unless they had superior numbers, leaving would often have been more advisable than staying put and fighting. Furthermore, it was likely that adequate resources could be found elsewhere.

The advent of agriculture produced a different situation. Agriculture allowed humans to be less dependent on the vagaries of nature because they could plant and care for their resources. That allowed humans to stay in one place and build relatively permanent housing and more permanent tools. But that also meant they were now bound to the land, the leaving of which would entail much greater loss. For this reason, defending the land became a more important goal. The motivation to stand and fight became greater as did the likelihood of war, the results of which might be catastrophic. Under such conditions, obligatory coalitions among stable groups of agriculturalists became advantageous. Neighboring farms would be under similar threat and thus larger groups would become allied and organized with a

hierarchical structure involving a strong leader (e.g., a king) who could provide protection in the form of an army. As the coalitions grew larger, their members would not likely know each other, and it would become important for the group to have a similar background story, a common culture based on similar myths or religions. Such a group would be more stable, and their common stories would allow members to trust each other. Thus, it is likely that agriculture was responsible for the need to organize into large groups for defense, while language provided the means for agreement on the norms and rules for resolving disputes.

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Author's Response

Author's response: The challenge of peace

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Abstract

The 30 commentators are largely sympathetic to the account I develop for the origins of peace in humans, though many suggest that peace has deeper roots and that humans share characteristics of peace with other species. Multiple commentators propose how to extend my framework or focus on the cognitive and psychological prerequisites for peace. In my reply, I discuss these considerations and further my account of why I think peace as defined here was unlikely prior to behavioral modernity which emerged approximately 100,000 years ago. In general, there seems to be a consensus that moving the debate beyond “war versus peace” in human evolution and instead focusing on the conditions that enable war or peace is a fruitful direction for the field to take.

R1. Introduction

Was life among our early human ancestors best characterized by harmonious intergroup relationships or was the threat of war ever

present? I have argued that neither of these views is likely to capture the reality of intergroup social relationships during human evolution. Rather, I presented a framework in which individuals and concomitantly groups struggled to balance tensions between conflict and cooperation. It would have been individually advantageous for early humans to interact cooperatively with out-groups, especially once our reliance on cultural technologies increased. This is consistent with strong evidence of intergroup trade emerging around 300,000 years ago. But peace in humans is more than ad hoc or intermittent cooperation, it consists of stable harmonious interactions where conflicts are prevented and resolved.

While most individuals may be better off with peace, it only takes a small number of self-interested individuals to initiate a conflict that then involves the entire group. I argued that intergroup conflict would have been likely to occur at least periodically among our early human ancestors because some individuals may have benefited asymmetrically from lethal violence, such as through the theft of material goods, the taking of captives, and status benefits. Preventing individuals from initiating intergroup violence when they may benefit from it, and then resolving violence when it does occur requires the psychological capacity follow norms and the social mechanisms to enforce norms. I argued that enforcing norms that impose individual costs requires strong social institutions, including coercive mechanisms and leadership. Based on the available archaeological evidence, the social institutions required to prevent individuals from unilaterally using lethal violence against out-groups were unlikely to have been present before 100,000 years ago. Thus, cooperation with out-groups is very old, but peace as I have defined it, is likely to be much more recent, developing within the past 100 thousand years.

The 30 commentaries provided insightful and stimulating discussion that will surely advance the field. There was large agreement that human evolutionary history is not one solely of war and that cooperation, and possibly peace, predates agriculture extending much deeper into our history (>100 kya). In general, there was an appreciation that the evolutionary human sciences needs to move past the debate about whether war or peace characterizes our history and instead focus on the specific conditions that give rise to intergroup violence or cooperation and their adaptive consequences. I reply to the commentaries grouping them by theme. In section R2, I discuss commentaries that focus on the definition of peace; in section R3 I focus on the relationship between multilevel societies and peace; in section R4 I consider earlier origins for peace. Section R5 focuses on the distinction between internal and external war, while in section R6 I discuss commentaries that focus on how to study and enforce peace. In section R7, I consider the evolutionary psychology of peace; in section R8 I focus on extensions of the framework the target article develops. Finally, I conclude in section R9.

R2. Defining peace

Most scholarship on peace uses a negative conception of peace defining it as the absence of war. I argue that the lack of war does not capture what we mean when we use the term peace. An absence of war may be maintained through the threat of violence or avoidance, and lack the positive aspects of intergroup relationships that we generally infer with the term peace. The target article defines peace as a state where one can expect to harmoniously interact across social group boundaries and expect to do

so in the future. Crucially, we expect that serious conflicts or violence is unusual and does not represent a group-held norm. In a state of peace, we can safely interact with, travel among, and even live with other groups all while maintaining membership in a distinct out-group. Once humans achieve peace, we do something extraordinary with it. We create interdependent systems where we depend on the resources or technologies that other groups provide for our survival. This intergroup interdependence is a key factor in enabling the success of our species.

Several commentators take issue with my definition of peace and by extension implications of my argument. **Antony** argues that a more useful definition of peace would include groups that have little interaction and interdependence with each other and use avoidance to prevent violence. **Romano, Gross, & De Dreu (Romano et al.)** argue that my restrictive definition of peace, in which stable positive-sum interactions are generally present, ignores situations in which interdependencies may be negative-sum, and in these cases it is much more difficult to reach peace. For them, a simpler and more useful definition of peace is simply the absence of conflict. This may or may not lead to cooperation, but is necessary for the establishment of cooperation. I agree with **Romano et al.** that a lack of conflict is likely required for cooperation (a point also made by **Samuni, Wessling, & Surbeck [Samuni et al.]** for bonobos). I recognize, as **Antony** points out, that groups sometimes avoid each other and in doing so lack conflict, which meets the criteria for a negative definition of peace. But peace is more than avoidance or even tolerance, and it is more than periodic cooperation scaled up. It is the ability to reliably interact with members of other groups with reasonable assurance of safety despite having membership in a distinct social group. In humans, this appears to require the ability to prevent and resolve conflicts. A state where two groups avoid each other, or lack overt conflict but do not cooperate appears substantively different than peace.

R3. Multilevel societies and other species with intergroup cooperation

Three commentaries (**Grueter; Samuni et al.; Wilson**) point toward the fact that some species, including humans, gelada monkeys, and hamadryas baboons, live in multilevel societies in which several social units coalesce creating higher-level forms of organization, such as several families forming a band or community, or members of a tribe belonging to different clans or territorial sections. The conditions that enable multilevel sociality in other species and our own may also facilitate peace, and a comparative perspective that includes them would be useful. Further, as **Wilson** points out, our prehuman ancestors may have lived in multilevel societies making the transition to cooperative relationships with out-groups easier. I agree that multilevel societies may provide important insights into the conditions which favor the evolution of cooperation between social groups. It is also plausible our prehuman ancestors lived in multilevel societies facilitating the development of peace but so little is known about the social organization of early *Homo* and earlier ancestors that inferences are tenuous. However, cooperation between subgroups of a multilevel society is less of a puzzle than peace, which occurs between socially distinct groups. This is because in a multilevel society members of different subgroups are still members of a single social group, just as a set of families in a community are all members of a community. This overlapping membership aligns incentives and provides more opportunities for monitoring and policing behavior than can

occur between groups that otherwise have little contact. But I agree that consideration of multilevel societies can shed light on the factors by which peace emerges.

Several other commentators illustrate that other species may have aspects of peace or peace itself. **Grüning & Krueger** take issue with my claim that peace as I have defined it appears to be human-unique. Their reply is wary of anthropocentric arguments that take human behavior as unique and then seek to find the human characteristics enable it and I agree. Humans may not be alone in having peace, but peace on the positive definition is rare appearing in only a few other species. **Grüning & Krueger** also point toward evidence from chimpanzees showing social learning, and what they infer is norm compliance and enforcement. While I am sensitive to the myriad ways in which chimpanzees and many other species have complex social lives, including social learning, on my interpretation of the research from primate cognition and behavior, I do not see convincing evidence of norm compliance. Humans appear alone in being able to create and follow arbitrary and even self-harming norms.

Samuni et al. provide valuable insights into the behavior of wild bonobos including that while bonobos have intergroup aggression, the rates do not seem greater than within-group aggression. This is a fascinating insight suggesting reconsideration of what we consider as peaceful interactions and suggesting that bonobos have at least some aspects of peace, even on the restrictive definition I propose. They argue that unlike humans and chimpanzees, bonobos are able to avoid war through lacking high levels of proactive aggression that makes war likely in humans and chimpanzees. This, along with the commentary by **Robinson, Rodrigues, & Barker (Robinson et al.)** illustrate that there is more than one pathway to peace. **Robinson et al.** argue that some species of ants engage in long-term sharing of resources between nests. Because ants have an unusual reproductive structure, workers are unlikely to benefit from conflict except through benefits to their queen. This is in contrast to humans where individual participants in conflict can benefit reproductively. They also note that age-related costs and benefits are different between humans and ants. In humans, youth, especially young males, typically gain the most from participating in war, while ants lack similar age-related asymmetry. However, ants that have this form of intergroup cooperation typically are highly related to each other having been founded by a few individuals who then form interconnected nests. In this case, relatedness alongside the reproductive structure facilitates peace, while humans must rely on social institutions to create peace. These similarities and differences provide important insights into other pathways to peace.

These commentators, along with **Majolo**, all note that our knowledge of the behavior of other species is increasing so we should be wary of claims that attribute a unique behavior to humans. We need to engage in more detailed systematic cross-taxa studies to better understand whether other species have peace, and the pathway to the evolution of our own peace, and I agree.

R4. When did peace evolve?

R4.1. Peace within the past 100,000 years

I argue that there is evidence of human intergroup trade, and by extension, cooperation, beginning 300,000 years ago. However, as with other inferences based on the paleoarchaeological record, dates are unlikely to represent the earliest instances of a behavior due to sampling biases. It is plausible, then, that

intergroup cooperation is older but that evidence for it has not yet been found.

However, I argue that peace is more than just cooperation – it refers to durable, harmonious relationships between groups. Societies in the middle Paleolithic were likely decentralized and egalitarian within age and sex. This social structure makes regulating the behavior of any group member difficult. At the same time, there were likely to have been some benefits from intergroup violence, such as obtaining valuable resources, or reproductive opportunities. At the same time, intergroup conflict could also arise simply from a misunderstanding. Given these conditions, it would have been exceedingly difficult to prevent unilateral aggression by motivated individuals and then to resolve it once it began. Thus, I argue that although cooperation is ancient, peace was not likely to occur until sufficiently strong social structures developed to regulate individual behavior and enforce group-based norms.

Many commentators disagree with the timing I propose and argue peace is much older. **Antony** for instance, argues that peace was a gradual process and emerging well before 100 kya because, he posits, our capacity to sanction within-group norm violations is much older. **Fuentes, Kim, & Kissel** argue that even at the birth of our species around 300 kya our species would have been able to engage in “peacefare.” Intriguingly, they argue that conflict well before the 100 kya date I give would have fueled the development of social structures that could promote peace. **Wrangham** seems to be in agreement with this timeline arguing that language was likely present at the birth of our species 300 kya and would have contributed to peacemaking between groups. **Pisor, Smith, & Deminichuk (Pisor et al.)** argue that intergroup cooperation, and possibly peace, would have been present possibly at the beginnings of our genus 2 million years ago due to marriage exogamy where individuals marry members of other groups. Such exchange, they argue, would have fueled intergroup cooperation and alliances. **Montoya & Pinter** make a more extreme claim appearing to argue that peace predates the *Homo* lineage when the brain size of prehuman ancestors began to increase due to navigating increasingly complex social relationships.

Hypothesizing about when peace emerged depends on the definition of peace one uses. If peace is periodically cooperative and generally nonaggressive interactions, then peace is likely to have emerged when individuals and groups would have benefited from interacting with out-groups. On this definition, peace probably well precedes the origin of modern humans, appearing at least since the birth of our species, and possibly earlier as **Pisor et al., Montoya & Pinter**, and others argue. If peace is stable, harmonious relationships without the threat of violence, then given the potential benefits one could possibly obtain from violence against out-groups (goods, reproductive opportunities, etc.), peace likely developed when we were able to create social institutions that can prevent and resolve such violence.

I am skeptical that an increase in brain size would have fueled peace as **Montoya & Pinter** argue because presumably it would also enabled conflict for the same reasons. I am also skeptical of making too much of the role of reproductive exogamy that **Pisor et al.** suggest because chimpanzees have exogamy but also high rates of lethal intergroup violence. However, when reproductive units (pair bonds, etc.) transformed into the cultural institution of marriage, then it seems more reasonable to think about reproduction being used to aid intergroup alliance formation (Walker, Hill, Flinn, & Ellsworth, 2011). But marriage, on my interpretation, is likely to be a more recent development in our

species' history. I agree with **Antony** that the emergence of peace was a gradual process and I did not intend my date of approximately 100,000 years to be taken as a bright line but instead to represent a range from approximately 150kya to 75kya or so. However, I disagree with **Antony's** assessment that peace would have been present significantly deeper than 100 kya because, as the target article shows, regulating norms for peace requires social institutions that were unlikely to have been present prior to these dates.

Overall, I am extremely sympathetic to the position of these commentators that intergroup cooperation and peacefare is much deeper than 100,000 years and likely predates our species. And if our prehuman ancestors lived in multilevel societies as other commentators have noted (**Grueter; Wilson**) we would have been well on our way to developing peace. Yet, I am still skeptical of whether there was full blown peace as defined in my paper earlier in our species' history for two reasons: (1) Intergroup cooperation would be expected to leave archaeological remains. Although humans and our prehuman ancestors have been using stone tools for several million years, the evidence for intergroup cooperation through stone tool trade is absent before 300,000 years. (2) Not only does intergroup contact leave archaeological remains, but it also fuels cumulative cultural evolution, and there is little evidence of this early in our species' history. On my interpretation prior to the past 100,000 years ago, the cultural tool kit of humans was simple, not rich, diverse, and changing like one would expect with regular intergroup cooperation and peace. Further, the simple tool kit indicates to me that there are fewer benefits to be gained from regular intergroup interaction.

R4.2. The coevolution of material technology with peace

In the target article, I argued that between 615 and 500 thousand years ago, our prehuman ancestors became increasingly choosy about the lithic materials they worked with. Approximately 300,000 years ago, evidence of what I interpret as intergroup cooperation in the form of trade emerges in the form of long-distance lithic transport. From 615,000 years onward, and especially from 300,000 years I would expect increasingly cooperative intergroup interactions. However, *it is only within the past hundred thousand years [150k–75k], that our species begins to produce distinctively human behaviors*. During this period, innovation and wide variation in material and stone tool technology develops, alongside the other distinctive hallmarks of *Homo sapiens*, including art, music, status markers, and a complex and varied tool kit (Aubert et al., 2019; Brumm et al., 2021; Henshilwood, d'Errico, Vanhaeren, van Niekerk, & Jacobs, 2004; Mackay et al., 2022; Marean et al., 2007; Režek, Dibble, McPherron, Braun, & Lin, 2018). Taken together, these are often referred to as *behavioral modernity* and it is generally recognized to have emerged within the past 150 kya (though some argue for earlier origins; Kissel & Fuentes, 2018).

A leading explanation the origin of behavioral modernity is that demographic changes, including increases in population size and density, facilitated the development and maintenance of cultural complexity, which likely included increased complexity in social organization as well (Powell, Shennan, & Thomas, 2009; Shennan, 2001; Stiner & Kuhn, 2006; Zilhão, 2007). Prior to this, humans were thought to be biologically and cognitively adapted for complex cultural traits but the demographic processes to sustain them once developed were lacking. Once the requisite demographic shift occurred, complex cultural traits could be

sustained. At the same time, the development of more complex and specialized material and social technologies would have fueled increased intergroup contact, which would have in turn fueled more cultural evolution.

While intergroup cooperation would have likely occurred prior to evolution of behavioral modernity, maintaining and developing it into stable harmonious relationships requires complex structures to prevent and resolve conflicts when individuals may benefit from intergroup conflict. Those social structures were unlikely to be present before the revolution that ushered in behavioral modernity. *It seems a stretch that our species could build the complex social technologies for peace while lacking other behavioral modern traits*. These include group-functional norms and the social structures to enforce them, alongside the flexible cultural technologies to resolve conflicts through peacemaking (sanctioning, rituals, wergild).

Instead, I think it more plausible that the factors that fueled one, fueled the other: When our material technology increased, so did our social technology. These both drove and facilitated intergroup contact, eventually resulting in the capacity to construct peace systems. It seems unlikely that a population of early humans who were incapable of flexibly responding to changing conditions with their material or social culture could build the flexible social systems required for peace. Prior to behavioral modernity, we may have had often cooperative relationships between groups where we sometimes exchange stone materials or mates through exogamy. But the transformation that enabled peace – the ability to regulate behavior with norms – only emerged with behaviorally modern humans. Based on the archaeological record, it is likely that most of those changes occurred in the past 100,000 [150kya to 75kya] years.

R5. Internal and external war

Hames; Pisor et al.; and **Wrangham** all note that I bypassed the discussion of internal and external war, and they argue that considering it may provide insights into the peace process. Internal war is war that occurs between groups that are members of the same society (such as feuding, civil war, etc.). External war is war between members of different societies, who typically have different languages or cultural practices. **Hames; Zentall**; and **Wrangham** all note that language may have had a crucial role in facilitating peacemaking among groups that speak intelligible languages (internal war). I agree that a shared language and cultural system appears conceptually to facilitate peacemaking.

I avoided the discussion of internal and external war for two reasons: A lack of space in the manuscript and I am unconvinced that it does much work in explaining war or peace. A shared language and culture may in theory facilitate peacemaking. But societies that share language and culture may be more likely to border each other, or to otherwise come into contact thus fueling conflict. It may be more difficult to create peace due to deep-seated grudges from a long history of conflict than between groups that have only had a few intermittent conflicts. These are empirical questions we do not know the answer too. But even when societies are distinct from each other, few human societies are as atomistic as those in the Andaman Islands, who are often used as a canonical example of external war. Instead, most societies, even ones that have external war with each other, often have friendships and some trade across group boundaries.

Pisor et al. note that in addition to not distinguishing internal and external war, I am also vague on the definition of a group (a

point also made by **Mathew & Zefferman**), which creates ambiguity, especially with regard to pacification by state society which typically occurs through the threat of violence. They suggest resolving the apparent contradiction through distinguishing between internal peace and external pacification. This is a good point I had not considered. It also bears noting that the process of fusing and merging multiple groups who were previously at war occurs through violence and force either in the process of pacification by states, or through conquest.

R6. Paradigms for peace

R6.1. Peace as a social dilemma

Multiple commentators focus on my treatment of peace as a solution of a prisoner's dilemma, making useful suggestions about how to extend this work. **Jeffries, Wright, & Lew-Levy (Jeffries et al.)** see my argument as a starting point for modeling and ethnography to be used in tandem to better understand peace, and I heartily concur. They suggest a number of considerations for employing such a dual framework, including the use of iterated games, the revealing of in-group participant identities, and possibly using multiple games in parallel to capture varying aspects of the social dynamics. Their dual framework for exploring social phenomena through ethnography and well-chosen experiments and models could be, and perhaps should be, applied to multiple phenomena. Regrettably, much of contemporary evolutionary human sciences tends to overlook the crucial importance of ethnography. Ethnography is not only important to understand the phenomena but should also be a critical component of deciding which experimental paradigms are most likely to capture the relevant parameters of the social phenomena we seek to understand.

Böhm & Columbus argue that conceptual accounts such as the one I have provided need to be supplemented with economic games to better identify and study the mechanism of peace, and I fully agree. They note that some well-established games such as the intergroup parochial and universal cooperation game are appropriate to test the conditions of peace. **Fischer, Avrashi, & Savranovski (Fischer et al.)** correctly point out that the prisoner's dilemma I use as a conceptual foundation for understanding the problem of peace is the tiniest slice of potential ways to model social interactions. There are hundreds, if not thousands, of other ways to consider payoffs from various strategies that would provide insight into the evolution of war and peace, some of which may better capture the social dynamics. They suggest a different paradigm than the prisoner's dilemma, called *subjective expected relative similarity* which appears to cover the broad set of 2×2 games, as well as the preconditions I stipulate for peace. Their model integrates various kinds of information into a single-decision rule of whether to cooperate or defect and is arguably computational simpler. Whether their model, the PD, or some other game best captures the social dilemma of war and peace is an open question but one that demands more research.

As all these commentators note (**Böhm & Columbus; Fischer et al.; Jeffries et al.; Romano et al.**) a critical step in understanding the evolution of peace is beginning to use the well-developed experimental and analytic tools that have been used to study war to examine the conditions in which peace emerges. My hope is that this paper will stimulate new experimental and modeling work into better revealing the conditions in which peace emerges.

Several commentators took issue with my framing of peace as the outcome of a prisoner's dilemma where players choose

between cooperation and defection (aggression) where peace is the solution. **Montoya & Pinter** argue "Groups avoid conflict – and even seek peace – when given the opportunity. Laboratory variations using 'minimal' groups (Tajfel et al., 1971) show that when group members allocate resources to the ingroup and outgroup, they divide money equally between them." While I agree with a number of other points in their commentary, I strongly disagree with this assessment. *A key contribution of my paper is that the framework whereby groups have agency such as in "groups avoiding conflict" is conceptually incompatible with small-scale decentralized groups. Rather than speaking of groups as having agency, the locus of action is in the individual and their actions then have consequences for the other members.* Further, while the research by Tajfel et al. in 1971 may show that money between groups is allocated evenly, much recent experimental work demonstrates that the path to conflict between groups is easy, and group members often do not make even allocations between their own group members and other groups (Dogan, Glowacki, & Rusch, 2018, 2022).

Imada & Mifune make the important point that individuals and groups are free to do nothing – neither cooperate or defect – but simply avoid others. Without consideration of this third strategy of doing nothing, they argue I overestimate the likelihood of conflict. I focus on these two strategies because the strategy of doing nothing does not lead to peace or war and these are what I seek to understand. A strategy of "do nothing" leads to avoidance, which begs little explanation. Further, humans seldom avoid other groups, our psychology seems motivated to seek out and approach others, which is one reason we have been able to successfully colonize the globe. Further, experimental games to study conflict where the "do nothing" strategy may dominate typically involve making an allocation of a low-value currency between oneself or one's group members, and anonymous others of another group. While this may represent the state of the art for studying intergroup relationships, I'm skeptical about pushing it too far. Opportunities to interact with other groups versus avoiding them has a very different salience in the real world than in lab experiments where doing nothing involves not splitting or taking money with anonymous others. Humans are curious, often impulsive, and it will be exceedingly difficult to avoid visiting one's neighbors or strangers if one lacks information about them. The history of group relationships in our species often involves doing something, not nothing. So while I agree the strategy space does include doing nothing, I do not think it materially alters the conceptual framework I've developed about the difficult and requirements for peace.

The second important point **Imada & Mifune** make is that social structures can also instigate people into participating in conflict. I fully agree: My own research has shown how leaders and cultural institutions can solve the collective action problem in warfare (Glowacki et al., 2016; Glowacki & McDermott, 2022; Glowacki & von Rueden, 2015). In the target article I write, "*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.*" The point is that social institutions can be wielded to promote any behavior – for good or harm. As the institutions and their associated norms become more powerful, their efficacy at promoting war and peace also increase.

R6.2 Mechanisms enforcing peace

In the target article I argue that peace requires the ability to enforce potentially costly norms, including nonaggression,

cooperation, and restitution. Based on a variety of ethnographic support I argue that the societies that appear to be able to do this successfully often do so with strong sanctions, potentially including physical punishment. While I am not explicit about it, the implication is that verbal sanctions, such as gossip, or exclusion are likely to often be insufficient for costly norm enforcement. Both **Huang** and **Lie-Panis & André** argue that I underestimate the importance of reputation in the evolution of peace. **Lie-Panis & André** elaborate on the framework I have outlined and provide new testable predictions. While they agree with the thesis in the target article that cultural technologies solve the cooperative dilemma between war and peace, they insightfully note that these technologies are also solutions to cooperative dilemmas. They hypothesize that they do so by leveraging reputation, which then solves the first-order cooperative dilemma. This is an intriguing proposition – and I agree reputation is a powerful mechanism in small communities. I am unconvinced, however, that reputation alone is enough to fill in the gap. I look forward to seeing the authors further develop this line of thinking.

Huang takes issue with the emphasis I put on strong sanctions, arguing that reputational sanctions are likely to be more effective at promoting peace. I agree with **Huang** that immaterial sanctions, including reputational damage and social rejection can be very effective at enforcing social norms, and in some cases perhaps more effective than physical sanctions. Further, reputational sanctions appear more common in hunter-gatherers than material or physical sanctions (Garfield et al., 2023). My argument about the importance of stronger sanctions is based on ethnographic observation but is not intended to imply that reputation is not important, only that it often appears insufficient. During the course of my own research with east African pastoralists who regularly participate in intergroup raiding, discussions of raids would often involve consideration of the response of community members. However, what appeared to be of more concern was the withdrawal of material support, especially livestock. More research will hopefully resolve the relative importance of differing kinds of sanctions.

R6.3 Group structured cultural selection

Mathew & Zefferman's commentary focuses on areas I was unable to cover, especially why certain norms are transmitted. They note that the Turkana, like other multilevel societies, consist of multiple subgroups and norms regulating behavior between subgroups promote cooperation, while norms between different societies (such as Turkana and Samburu) are more likely to promote conflict. They make the point that I argue that peace is a challenge that requires norms to solve, but instead of developing norms for peace, groups could just drop war-promoting norms. I disagree, in part, with this assessment. In the target article, I make it clear that many societies do have norms that promote war. However, I do not mean to imply that norms are necessary for participation in small-scale decentralized warfare that primarily takes the place of ambush raids where attackers face low risk. Peace is more of a challenge than war because small-scale decentralized war does not necessarily require norms for participation, just as lethal raiding in chimpanzees appears to occur without norms. Participants may directly benefit from warfare without norms through capturing items of material value, being motivated by an evolved psychology for revenge, or by gaining reproductive opportunities through coercion, or through other pathways. Thus, small-scale decentralized war in the form of ambush raids in humans and chimpanzees may not be a significant

collective action problem (Glowacki & Wrangham, 2015; Massaro et al., 2022). As war becomes higher cost and on a larger scale, norms for participation are expected to become more important, as Mathew's previous work has shown (Mathew, 2017; Mathew & Boyd, 2011).

Mathew & Zefferman note that I do not identify a mechanistic process for the patterning of peace and war. They argue that the patterning of peace and war can be explained by group-structured cultural selection. This is a plausible explanation for the spread of certain norms but does not explain where the norms for peace and war initially come from. Elsewhere I have argued that norms emerge from individuals who have overlapping self-interest and then enforce their interests on others (Singh, Glowacki, & Wrangham, 2016, 2017). Because groups are composed of heterogeneous individuals with different interests, and the same individual may have competing interests, norms for peace and war may coexist in a group and eliminating a category of norms, such as those promoting war is difficult.

R7. The evolutionary psychology of peace

R7.1. Cooperation

McDermott; Baumeister & Bushman; and **Montoya & Pinter** all note the important role that within-group relationships had in the evolution of the capacity for peace. **McDermott** correctly points out that cooperation precedes intergroup cooperation and was likely a crucial aspect for the evolution of our species, both helping us compete against other groups, but also against nature. In part, our cooperative abilities may have emerged to help humans manage within-group conflict. Both **McDermott** and **Baumeister & Bushman** argue that leadership may be an important part of this. Cross-cultural work supports their hypothesis demonstrating that across small-scale societies leaders tend to have a primary role in conflict management (Garfield, 2021). **McDermott** makes the insightful observation that if intergroup war is mostly male coalitionary behavior, then the evolution of cooperative tendencies may have evolved differently for women. This is an underexplored area of research; however, among small-scale pastoralist societies, my own work shows that women, not just men, may have a critical role in resolving in-group conflicts (Garfield & Glowacki, 2023). There is convergence between the approach I develop in the target article and the commentary by **Baumeister & Bushman** who have argued that becoming human required the human mind to develop in a certain way so that it can both adopt and create culture. In the case of peace, this required capacities such as social identity, norm enforcement, and tolerance. They point out that the cognitive requirements that underlie peace, probably evolved due to pressures in other aspects of social life, such as in-group interactions, but then facilitated out-group cooperation.

R7.2 Cognition

Coolidge notes that radical evolutionary changes in behavior almost assuredly require neurobiological reorganization, which my account neglects. **Coolidge** proposes one such change, the expansion of the parietal lobe, which allowed our ancestors to better regulate their emotions and expanded our capacity for theory of mind. Both would have had made cooperative intergroup relationships more common. **Coolidge** argues that the function of the parietal lobes may be an exaptation, rather than the product of

selection for that function. As the field of evolutionary neuroscience is still in its infancy, these questions remain unresolved. **Riordan** points out that peace requires other cognitive mechanisms to be in place, most importantly common knowledge and the ability to mentalize the states of others, and I agree that this is an important prerequisite for solving the challenges of maintaining harmonious relationships between human groups.

Sijilmassi, Safra, & Baumard (Sijilmassi et al.) appear to largely accept my argument and illustrate areas where there is articulation with work in social cognition. Crucially, they note that peace requires the ability of human agents to keep track of positive and negative social relationships, which they term an alliance detection system. Other factors underlying peace institutions, such as leadership and sanctioning, may also engage core aspects of social cognition. Indeed, the authors cite research showing that these sometimes function as cues that individuals use to infer cooperative networks. As Sijilmassi et al. note much more work remains to be done. When and why did these capacities evolve? Were they specific for intra- or intergroup relationships or coopted? To what extent are they shared with other species, or do other species achieve tolerant intergroup relationships while lacking them?

My account of peace requires that humans are able to follow and enforce group-based norms but understanding how and when humans evolved a norm psychology is one of the great challenges of human evolutionary studies. **McCullough & Pietraszewski** focus on the computational difficulties involved in achieving group-based norms. Specifically, they argue that doing so is achieved by simpler three-person interactions which are used to project group membership. Then the dynamics to reach a group-based decision, which is based on what the other group is projected to do are exceedingly complex, resulting from individuals with their evolved psychologies competing to promote their interests. This is consistent with the framing the target article provides and is one reason why norms that require individuals to act against their own self-interest are so hard to achieve.

R8. Extensions

Multiple commentators pointed out areas of the target article I neglected or that could be extended. **Zentall** argues that shared stories can bind groups together, or even transcend groups, enabling separate groups to find commonalities, though it could also be used to fuel conflict. Narrative is a powerful factor in shaping the behavior of individuals but it remains an open question of the extent to which it shapes intergroup relationships among hunter-gatherers. On my reading of the literature, it has only a small role at most. But further, while narrative may facilitate peace, it does not seem to be required for peace, and potentially can also be used to promote intergroup aggression. **Kiper & Sosis** note that I argue that cultural knowledge, including values and norms can enable peace, and imply that I argue that religion in early human societies promoted peace. However, in the target article I am conspicuously silent on religion precisely because we know so little about the timing of the first religions and their belief structure. Insofar as early religions resemble those found in more recent small-scale decentralized societies, religion probably did not feature prominently in regulating intergroup conflict. When and where it did, I agree with **Kiper & Sosis** that it may have facilitated both cooperation and conflict depending on the circumstance and that religious beliefs may have developed in response to local conditions, including war and peace.

Both **Hames** and **Zentall** focus on the role that resources may have in promoting conflict. **Zentall** argued that the development of farming would have increased the need to negotiate boundaries between groups. He notes that this subsistence transition would have fueled changes in social organization, including expanded forms of alliances and hierarchies that may have facilitated both war and peace. I agree that there is a strong relationship between social organization and subsistence but I think the role of agriculture compared to hunting and gathering remains unclear. Some foragers are well-known for hierarchical and coercive forms of social organization including property ownership and even slavery. **Hames** notes that population density may be associated with higher rates of war among many small-scale societies, perhaps because of increased competition for food resources. Mobile hunter-gatherers typically have lower rates of war, while presumably having lower competition for food resources. While I agree with **Hames** that resource competition and food production are important factors in understanding war and peace, and a full explanation of war will connect group-level benefits such as potentially expanding territory, to individual motivations for war. If a group is successful in war and all members can expand into the neighboring territory, why would any individual participate in war, and not just free-ride on others? This is part of the central dilemma of the collective action problem in war.

Rusch takes the approach to framing the challenge of peace as one of policing. He points out that policing presents its own problems, and in decentralized groups with strong degrees of personal autonomy it may be especially difficult. Because one does not know if oneself will be the victim of retaliatory violence, sanctions for norm violations resemble third-party punishment. But third-party punishment appears rare in small-scale societies (Fitouchi & Singh, 2023; Singh & Garfield, 2022), exactly the type of punishment that would be needed to curtail a group of would-be raiders. **Rusch** notes that I do not address how early peacemakers, states, and colonizers are able to resolve the policing dilemma. He hypothesizes the emergence of something akin to a “peacelord,” or leaders who balance the urges of youth with the interests of the entire group. In societies without a strong governmental presence, **Rusch** notes that gangs and nonstate actors do solve the “policing” problem of peace with young men endogenously organizing enforcing their monopoly on violence, and creating a form of peace. These are tantalizing questions about which we know so little in small-scale societies.

Brown, Brown, Cavallino, Monterroza, Li, & Huang identify that aspects of my argument may be relevant to understanding how to create peace today among humans. They focus on how to get groups to increase their interdependence through promoting interpersonal relationships or avenues for cooperation. At the same time, many areas of shared interdependence exist that may be unrecognized and further recognition may promote peace. I largely agree with their conclusion that increased recognition of overlapping interdependence would be useful in promoting peace. Applied efforts to reduce war and other forms of intergroup violence would be advanced through consideration of both the motivation of individuals, but also through careful empirical work. Unfortunately, many peace efforts appear to proceed without these considerations.

R9. Conclusion

My goal in writing the target article was to move the debate past the question of war versus peace in human evolution and to shift

the focus to the conditions which enable peace or war. In doing so, I have speculated on the nature of early human societies and when specific features such as intergroup cooperation, trade, and norm enforcement developed. It is my intention that this is a first statement of an ongoing discussion rather than a final statement. Thus, the account I offer is tentative, and will be surely updated as new evidence and new models emerge.

Several commentators make a strong case that polydomous ants, bonobos, and species living in multilevel societies have peace or important elements of it. Polydomous ants are typically highly related to their neighboring nests bonobos lack high rates of predatory aggression as well as potential benefits from raiding, and multilevel societies share social group membership. Thus, while humans may not be alone in having peace, we should be struck by the fact that this is still just a handful of species. Peace appears to be extremely rare, especially among species that regularly kill each other as humans do. This requires an explanation, and the target article provides one that I think still stands. At some point in our history, our species began to benefit from interacting with out-group members, possibly shifting from a strategy of avoidance, or tolerance to seeking out opportunities to interact. Our norm psychology alongside social institutions enabled us to create the conditions in which intergroup violence could be prevented thus allowing the development of durable harmonious intergroup interactions. We then developed cultural technologies allowing us to restore relationships after a conflict. Thus the pathway to human peace was long and not inevitable.

The last sentence of Mathew & Zeffernan's commentary is a fitting statement for understanding human war and peace. They write "if primordial propensities for war or peace exist, they seem to be quite readily overwhelmed by local cultural norms." While the human lineage may have contained conditions which favored lethal aggression between social groups, with the right norms and social institutions, whatever tendency there may be toward war can be suppressed allowing us to create peaceful harmonious societies.

Competing interest. None.

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