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# *Evolution of Human Cooperation: An Archaeological Approach Focusing on Hunter-Gather Society*

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***Abstract:*** The history and development of cooperation between people is a major topic in many areas. The most popular ideas about how cooperation started are cultural group selection and the idea of charity. Scientists have different responses to them, though. People have evolved and survived in many places over a very long time, so they must have left behind a lot of proof. This paper looks into the main reasons why people work together and how cooperation has evolved by collecting historical samples and ethnic records and analysing them along with other research. The poll results show that the main reason people work together is to get what they want. To stay alive in natural settings that are very complicated, people work together to build trust and reputation systems. The creation of ways to respond to different cultures and punish people who don't follow the rules has helped to keep socialised systems of cooperation that were formed when cultures clashed or mixed. Cooperation is something that everyone does, but different places have their own religious beliefs and cultural practices that shape how people work together. A lot of different things affect how cooperative people are, and it's hard to come up with a good theoretical model just from the studies that have been done so far.

***Keywords:*** Cooperation, Archaeology, Hunter-Gather Society, Acculturation, Reciprocity

## 1. Introduction

Cooperation is regarded as a behaviour that is fundamental to the stability of social life, allowing for the peaceful establishment of relationships between individuals and enabling everyone to work together to achieve the common interest. The extent of cooperation can be either a family or a joint organisation of several countries. Research on the origins of cooperation is fast becoming a key instrument in interdisciplinary studies, including evolution, biology, and psychology. Two theories that are currently the most widely discussed to describe the reasons for human cooperation are altruism and cultural group selection. Although each discipline does not define altruism in precisely the same way, it is usually defined as behaviours that are genuinely motivated by a desire to improve the well-being of others without expecting anything in return. Many scientists argue that altruism is inspired by a sense of social responsibility and compassion for others [1]. It encourages individuals to engage in positive social and ethical conduct to make the world a better place. Since 1872, biologists spearheaded by Charles Darwin have approached altruism from multiple perspectives in the natural sciences, where scientists have found that two altruistic theories, kin selection and reciprocal altruism, contribute to the interpretation of the evolution of human cooperation [1].

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Cooperation and altruism have traditionally been identified by scientists as interrelated pro-social behaviours. Collaboration requires a degree of altruism; individuals choosing to work together suggests that they need to give up some of the individual's benefits. Utilitarianism becomes cooperation when more people unite to work towards a more valuable collective purpose [1].

Nevertheless, cooperation promotes the interests of the population, whereas altruistic behaviour is lopsided, with no apparent advantage to the altruistic party. It has been pointed out that human cooperation with non-relatives cannot be explained by "kin selection" or "reciprocal altruism", rather it evolves through positive cultural selection [2]. Cultural group selection is a method of accounting for human pro-social actions, stating that social learning processes associated with social institutions can stabilise group behaviour and advance the origins of human cooperation [3]. Cultural group selection believes that better-organised, more technologically advanced and more cooperative groups can succeed in the competition of the community. This theory is primarily informed by three aspects: (1) cultural differences are the primary reason for variation in behaviour between groups; (2) the majority of cultural traits are transmitted and inherited over time; (3) different cultural features are the essential factors that account for the success of the expansion of communities [3]. Scientists suggest that cultural group selection is indispensable for conventions and behaviours to be passed on in a culture. This is not only applicable to contemporary human beings but also functions in the life of ancient populations. Humans acquire, retain and transmit cultural information through a formidable capacity for social learning, as well as conforming to the majority's action to address social problems [4]. This is one of the prime distinctions between humans and other species, which serves to perpetuate diversity among groups in a way that genetic and behavioural ecology cannot. Group selection, which creates different beliefs, ideas and values for cultures to generate collaborative traits among non-relatives.

Except for the theory of altruism and cultural group selection, academics have proposed hundreds of theoretical models for the initiation of cooperation, few of which have been accepted by the majority of the public. A major disadvantage is that human behavioural patterns vary considerably across cultures. What's more, psychology and standards of action have evolved over millions of years, making it problematic to judge ancestral behaviour models using contemporary research. It is essential to integrate the history-based disciplines to trace the lifestyles as well as the collaborative systems of ancestors. Archaeology and anthropology, as an intersectional subject that investigates the nature and development of large-scale human civilisational structures, provide substantial evidence referencing the processes of human cooperation and cultural evolution [5]. There is no previous research using archaeological evidence to approach the evolution of cooperation. Therefore, it is a fascinating perspective to study whether the origins of human interaction can be partly explained by prehistoric archaeological findings. The overall goal is to construct a basic theory of human cooperation through archaeological evidence that demonstrates the predominant reason humans opted to collaborate was for the sake of individual benefit. This paper will be divided into four parts. To begin with, it will provide a brief conception of two better-regarded theories of human cooperation and extend them to a comprehensive definition of cooperation. Secondly, it will demonstrate the cooperation in prehistoric civilizations through evidence of the use of fire. Another point worth mentioning is the punishments that individuals create to maintain fairness and rules in cooperation. In the last section, it will discuss the cases of large-scale collaboration for hunters in hunter-gatherer societies.

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## 2. The Literature Review of Cooperation

### 2.1. Previous Theories of Human Cooperation: Altruism

The fact that the vast bulk of individuals are friendly to strangers offers the possibility that the roots of cooperation were guided and influenced by altruism. The sociobiological theory proposes that "altruism" promotes collaboration between genetically related individuals, which is known as "kin selection" [6]. The kin-biased collaboration appears in the lives of most vertebrates. Archaeologists have uncovered that as opposed to the animal world, numerous traces of human life in Hunter-gathering societies indicate that to overcome complex natural environments, humans interacted frequently with non-relatives within institutional systems from the Late Pleistocene period onwards [4]. Behavioural economists have advanced a new argument in this context, namely that humans have pro-social instincts [7]. The strong concern for the well-being of others and the qualities of selflessness are the main factors that motivate humans to cooperate [7]. Emotional expression, especially altruism, is an unconscious signaling [8]. In the process of socialising, receiving the emotion of gratitude and trust from the person assisted, despite not being materially rewarded, generates a sense of well-being and a positive attitude towards life in the individual. This is due to the unique sense of self-identity along with altruism from human beings. Apart from that, a large volume of literature suggests that social identity has a strong effect on reciprocal altruism in humans [9]. For instance, people will be more helpful to in-group members than to extraneous individuals. However, altruism as a mechanism to promote cooperation has been sceptical by some scholars. One criticism of much of the literature on altruism is that scientists have experimentally demonstrated that human kindness tends to be normally distributed, with a probability of conflict for self-interest among individuals even if they are biologically related [10]. Individuals with strong altruism may abandon helping others when they notice that nobody is inclined to work together. An alternative view that has emerged is that altruistic behaviour is driven by the desire to acquire reputation and rewards. The primary purpose of people to be helpful in the group is to build social networks thereby increasing the potential for getting future returns. The only scenario that cooperation by virtue of altruism occurs between relatives and small groups in which everyone has a strong interest in each other’s ideas. Although altruism serves an influential task in the evolution of human cooperation, the primary purpose of cooperation is the exchange of individual benefits. Consequently, the origins of human cooperation need to be accounted for in combination with altruism and a complex array of interdisciplinary factors.

### 2.2. Previous Theory of Human Cooperation: Cultural Group Selection

Another theory that has been used broadly to interpret the establishment of large cooperative societies is cultural group selection. Cultural group selection is an example of an interdisciplinary study that provides valuable insight into the formation of large-scale complex societies and is an invaluable theoretical underpinning for the evolution of human societies [4]. Archaeological discoveries have shown that significant psychological changes and genetic variations occurred in humans about 5 million years ago [11]. Humans evolved a formidable capacity for imitative learning, linguistic expression and information transfer. Through sophisticated cognitive abilities, cultures and skills from diverse areas can be accumulated, spread and adapted by individuals [4]. No one is omnipotent in nature; cultural learning enables individuals to be mutually helpful to achieve complementary roles and common benefits [12]. Taking into account the scale and complexity of these transformations, scholars have identified them as a manifestation of cultural adaptation [4]. Although acculturation is an integral component of cooperation, few researchers have been able to draw on any systematic study into the extent to which the current concept of cultural group selection reflects the concept of

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the evolution of human cooperation. The key problem with cultural group selection theory is that archaeologists believe that cooperative behaviour is variable over the course of a generation [3]. It implies that collaboration can display rapid adaptability to shifting prehistoric environments and enhance intergroup behavioural differences. It is incompatible with the cultural group selection model, which states that it takes roughly 1,000 years for an innovation to spread from one population to another in other areas through cultural group selection [11]. Furthermore, scientists have investigated the ethnographic records of 60 societies around the globe (see Table 1) in an attempt to determine perceptions of cooperation and cross-cultural prevalence on a worldwide scale [13]. Seven cooperative behaviours arise in each of the 962 cooperative ethnographies. This supports that similar collaboration occurs universally across societies. It confirms that human cooperation possesses commonalities in both religions and cultures from hunter-gatherer groups to the modern state. In summary, the cultural group selection theory would have been more relevant if it could explain the prevalence of ethical cooperation in human societies and the biological adaptability of individuals.

Table 1: ethnographic records of Cooperation in 60 societies

| | Positive | Negative |
|---|---|---|
| Kinship | 214 | 0 |
| Mutualism | 127 | 0 |
| Exchange | 151 | 0 |
| Hawk | 101 | 0 |
| Dove | 133 | 0 |
| Division | 17 | 0 |
| Possession | 218 | 1 |
| Total | 961 | 1 |

Seven patterns of cooperation were present in each culture, including kinship, mutualism, exchange, hawk, dove, division and possession [13]. In 961 out of 962 of these societies (99.9%), cooperation had positive moral benefits. The only exception is the Chuukese perception of property rights. The Chuukese viewed theft as admirable because the behaviour showed that the individual was not intimidated by authority and power [13].

### 2.3. What is Human Cooperation

Human cooperation cannot be justified solely based on Cultural group selection or altruism but rather combines the strengths of both theories: mutual aid behaviours in interdependent societies resulting from natural selection, cultural evolution as well as the selection of reputations and credibility of collaborators. Similar to animal kingdoms, survival and reproduction are necessary in human society. Nevertheless, the intelligence and capacity of an individual is finite. To acquire sufficient resources for living, family members develop a stable sentimental bond and a unique social cognition of being of support to each other [12]. Cooperation between relatives is also regarded as a human instinct. It is not altruistic, instead, it is a collective action of equal and mutually advantageous based on the apparent benefits that will result from cooperation, such as individual benefits, public goods and

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reciprocation. The scale of cooperation grows as the range of human activities and groups expands. People discover that helping partners enables them to gain the credibility of others, leading to opportunities for long-term cooperation and wider personal advantages [14]. Rivalry for partnerships promotes concern for one's reputation. Simultaneously, cultural preferences are an essential part of human communities. With the expansion of communities, subsistence activities become more complicated. Over the past million years, the structure of the human body and brain has continuously evolved to create a multitude of solutions to survival problems. The other portion is cultural inventions, such as customs, conventions and laws, that have arisen through group intelligence. Individuals during long periods of group life evolve cumulative cognitive skills, such as coordination, signaling and partner selection [15]. In addition, imitative learning helps humans to spread survival skills over long periods of group life [12]. In contrast to genetic evolution, cumulative patterns of acculturation have enabled humans to rapidly develop survival skills adapted to environments. Inventing tools and community regulations promotes individuals to further enhance collaboration. Cultural adaptation increases variation within groups and promotes the elaboration of socio-cultural norms and values [11]. Concomitantly, conflicts over territory, food and other resources were ubiquitous. Archaeological and ethnographic data point to violent intergroup resource struggles in all regions of prehistory [15]. Clashes over resources lead to weaknesses being defeated by superiors by more powerful and united communities. To avoid compromising individual interests, communities need to be interdependent to compete with other groups through orderly cooperation [12]. As a result, people created conventions and punishment systems to constrain the behaviour of cooperators and promote the efficiency of collaboration. This is not a negative phenomenon, as ancient humans adapted to a wide range of environmental conditions by undergoing multiple cultural evolutions and mergers in the context of intense group competition, disseminating and mastering complex modes of production in different regions. The modern human race has also built large-scale, highly cooperative social systems founded on the merging and elimination of other cultures.

## 3. The Punishment in Communities

### 3.1. The use of Fire

The use of fire can be combined with human foraging, survival and adaptation to produce an integrated positive impact on the evolution of human cooperation. Almost all behaviour with the use of fire has invariably facilitated the process of cooperation. Although many animals are capable of responding to fire, only humans have mastered its production and utilisation. Archaeologists have analysed several archaeological sites with traces of fire and concluded that collaboration was pervasive in fire-using communities. Archaeological evidence indicates that humans started utilising fire about 1.5 million years ago [16]. During the Pleistocene period, the brain of humans engendered a massive evolution whereas eating cooked food was the only way to cause an increase in the number of neurons in the brain [17]. A developed brain facilitates the cognitive development of human beings to formulate rich ways of cooperation and invent more tools to aid in manufacturing. Beyond this, the emergence of fire improved human survivability, as prehistoric humans tended to cluster around fire sources to ward off cold weather. This allowed communities with fire to bond more closely with each other. Furthermore, the light supplied by fire also reduced the danger of people working at night [17]. Despite the many conveniences that fire brings to humans, it took millions of years for individuals to evolve the utilization of fire from the maintenance of opportunity fires to the control of embers, then the invention of ignition technology [17]. The charcoal formed by the prolonged burning of large campfires and the gradual build-up of traces of fire use detected in different strata of prehistoric human-occupied caves supports this idea. Archaeologists have uncovered a large burning feature including charred sediments, bones and heat-damaged tools in Qesem Cave, a human-occupied cave

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identified in the Levant [18]. This is sufficient evidence that ancient humans used fire to prepare food. Zooarchaeologists consider the need for bones to be stripped of their moist surface soft tissues before firing, demonstrating that humans invented tools to begin roasting animal remains only after tedious processing [18]. Disorganised, multi-angle cut marks on the bones indicate that the food preparation process was shared by multiple, technologically rusty individuals [18]. It is evidence of community division of labour and sharing of food products for harvesting, as well as the fact that human groups are strategic in spatial use.

### 3.2. The free-riding behaviours in the Fire Utilization Communities

Cooperation is a condition which, once achieved, can be applied to a broad range of circumstances in society to satisfy demands for benefit. Tight bonds between individuals in a collective generously share resources and increase the free-rider effect as well. The initial collective typically consists of 20 to 30 members [17]. Without excess labour, some scholars have contended that collaborative patterns are not affected by free-riding [12]. Free-riding behaviour, however, is inevitable in group activities. With a limited workforce, the risk of free-riding tends to be averted only when individuals are conscious of the advantages of cooperative reciprocity. The sustainment and utilisation of fire by small prehistoric populations is one of the indications. Before people knew how to create a fire, they were required to find a source of fire in nature, transport it to prevent it from going out. The fire not only needed to be large enough to resist extinguishing easily but also avoid resulting in mountain fires [17]. An optimally sized fire can cater for the diverse requirements of multiple humans simultaneously without incurring additional costs of supply [17]. For example, the thermal radiation from a fire can maintain warmth for many individuals concurrently while being used for cooking food. The expense of managing a fire appropriate for a single person is not significantly dissimilar to satisfying the fire demands of all members of the community, making it profitable for the free-riders. However, maintaining an optimal fire size was not an easy task for prehistoric humans. As the fuel available around it was depleted, people had to venture further afield for branches and animal dung to be available for fuel [16]. While preserving the flame, individuals must maintain the operations of seeking food and survival resources to proceed unimpeded. The balance of cooperation in a small group is disturbed when multiple free-riding behaviours occur, as not everyone is willing to undertake the extra tasks. The implication is that with active collaboration, everyone can reduce the risk of losing a fire whilst assisting others to reduce their workload. Domestication of fire therefore has a positive impact on individuals shifting from a focus on self-interest to helping each other and towards the development of group values.

### 3.3. Rules and Norms

The evolution of cooperation at scale depends on the support of social institutions. Cooperation at different scales and purposes plays a positive contribution to social construction [5]. Meanwhile, the complexity of the labour distribution and conflicting benefits result in a range of problems. Reliance on collective awareness no longer ensures the fairness of collaboration in sophisticated societies. An institutionalised punishment mechanism has gradually become a central feature of human cooperation to stabilise collaborative order [4]. It induces individuals to be disciplined and participate in a wide range of cooperative activities. If human society is viewed as a gigantic enterprise, the majority of people expect to share the costs and benefits of utilities in a fair manner [10]. Because everyone wants to enable the team to operate successfully to maximise the satisfaction of the individual's desires. Furthermore, collectivism motivates willingness to support and defend the interests of the partners [12]. As citizens of modern countries, people are accustomed to believing that the legal system is the only rule to prevent the destruction of individuals' benefits. The penal system however mostly

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monitors offences such as violence, theft and embezzlement. Modern societies have established legal norms for free-riding on public services. For example, a portion of citizens' taxes is intended to pay for street lighting and amenities. The issue of free-riding is a common challenge faced by communities: people who benefit from the efforts of others without contributing a stake to it [19]. The selfish behaviours that individuals encounter on a daily basis are regulated by culturally transmitted ethical norms, particularly the pursuit of fairness. The distinct levels of trust between cultures are essential in mitigating free-riding [19]. In societies with an elevated degree of trust, people may be guilty of their free-riding behaviour, which strengthens an individual's conception of cooperation.

### 3.4. Partner Selection Mechanisms

Ancient hunter-gatherer societies, as highly institutionalised societies, not only had rigorous social norms, but also built on the social model of partner choice and developed a "punishment" that is still in practice today to deal with free-riding troubles. According to the majority of experiments, individuals are willing to pay a price to penalise the non-cooperators, which is known as altruistic punishment [10]. Indeed, gatherer-hunter societies do not pay anything for punishing the morally corrupt, but rather based on individual interests. Collaboration is inherently about the individual's ability to acquire more resources while reducing work costs. The punishment of uncooperative individuals preserves the interests of the individual and the normative features of collaboration, as well as being perceived as a signal to promote beneficial social interactions [10]. In the mechanism of partner selection, each searches for reliable partners and is selected by others who are eager to be cooperative. Those who are deprived of a buddy in hunter-gatherer societies are exposed to considerable existential threats [10]. Therefore, cooperative individuals discipline morally corrupt members by ostracising non-cooperators from their social networks and establishing new mutualistic relationships with others [20]. In most cases, expressing dissatisfaction with ethically dishonoured members is adequate to motivate them to work together. Likewise, people leave and integrate into new communities when they find the leader's behaviour unethical or contradictory to their interests [10]. The partnership selection mechanism is one of the prerequisites for establishing a cooperative relationship. People discuss thievery, selfishness and uncooperativeness while praising honesty, generosity and helpfulness. Electively, individuals collaborate with one another by creating moral concepts and exchanging information about the performance of others. The ancient Athenian society invented a collective voting system called exo-ostrakismos that fairly excluded discredited and rule-breaking members from the community [5]. The stronger the willingness of community members to rigorously monitor collaborative behaviours among each other, the more effective the enforcement of collaborative norms will be. Psychological mechanisms of cooperation in contemporary environments developed in the hunter-gatherer societies of human ancestors [21]. For a substantial portion of human history, all communication was based on a system of trust and reputation, nobody would risk losing personal benefits by cooperating with an immoral person [10].

## 4. Large-scale Cooperation

### 4.1. Hunter-gatherer Societies

Collaboration is more than a manifestation of human evolution; it is a condition that contributes to the collective welfare. The motivation of humans to pursue multiple interests over long periods implies the existence of various shapes and scales of cooperation between populations. Cooperation in hunter-gatherer societies is extended to bilateral interactions between individuals, it also occurs in large-scale populations [9]. Whereas the collaboration of a small number of individuals may be sustained through mutual benefit, large-scale cooperation- especially as the population rises and the

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labour division intensifies - requires wide goals and collective knowledge to cope with issues [12]. The transition from hominids to foraging societies took millions of years. Prehistoric humans' survival was dramatically threatened by frequent climatic fluctuations. During this stage, people find it safer and resourceful to act together than to stand alone [15]. With the idea of avoiding danger and a constant personal need for resources, coincidental cooperation progresses into productive and long-lasting partnerships. Each person connects his or her success with others in the group, reinforcing the desire to support each other. In prehistoric civilisations, the cooperative, foraging communities are organised around the reduction of opportunity for risk and reciprocity. The effectiveness of foraging relies on the extensive survival experience of the people, high proficiency techniques, and adaptation to the local environment [15]. Small, egalitarian groups become large hierarchical societies by establishing rules and infrastructures [21]. Furthermore, the population needs to engage in group conflict together to maintain peaceful trade [21]. The scaled collective actions were vital to the survival of hunter-gatherers.

### 4.2. The Collaboration Examples in North America

Archaeologists have uncovered abundant evidence of massive prehistoric collaborative hunting in North America and Australia. Hunting reindeer was an influential aspect of the survival and economic advancement of the American Arctic Circumpolar region. Reindeer meat was an essential food source for the Inuit and Indians, while the hides were traditionally used for the manufacture of winter clothing and mattresses [21]. Reindeer are physically large and it is dangerous to kill reindeer through the efforts of one individual. To obtain adequate quantities of resources to cover the winter, populations had to work together as a unit. Hunt activities typically drove hundreds of individuals to work collectively. Ethnographic records indicate that the original method of hunting was for some individuals to chase the reindeer to the river, while the remaining adults would shoot the prey from the shore or on the lake in canoes [21]. With the evolution of human brains, Aboriginal people invented new approaches to hunting with limited natural resources. They transported timber and stone to build dozens of kilometres of fences to restrict the escape routes of the reindeer, gathering them into zones of complicated terrain [21]. A similar scenario occurred in the plains of North America. Utilising rocks, willow branches and hides, the natives constructed a drive system that propelled the buffalos to the edge of steep ravines and forced them to jump off the cliffs [21]. The consequent output of thousands of kilograms of meat and hides required numerous people to spread out the work to process the proteins before they spoiled. A wealth of archaeological evidence suggests that patterns of large-scale drivetrain hunting spread across the bulk of North America through cultural dissemination more than 6,000 years ago [21].

### 4.3. The discovery of Cooperation in Australian Aborigines

On the other side of the earth, Australian Aborigines were aiding in communal hunting through an abundance of proppants. Archaeologists have uncovered many remnants of hunting nets in the Australian outback. They were loosely woven in a semi-circular shape, with the longest nets being approximately 1km long [21]. In collaborative hunting, experienced hunters are in charge of catching prey with nets, while the rest of the party is involved in gathering the animals and driving them towards the location of the hunters [21]. It is more flexible than the North American drive system. Similarly, the manufacture of nets required a division of indigenous people. An experimental archaeological study determined that it took Aboriginal individuals up to four weeks to produce a 52 x 0.8 m net, exclusive of the time they spent searching for raw materials [21]. A comparable version of the durable trap net has been observed in Western Australia. It has a narrower mesh which was employed by the indigenous people for capturing seafood [21]. The systematic splitting of labour

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among hunter-gatherers is required for everything from the construction of drive systems to the preparation of meat products. By cooperation, individuals could obtain more benefits than if they performed alone while reducing costs and hazards. Sophisticated tools and facilities were designed with the intelligence and assistance of others to obtain large quantities of food. Collaboration is decisive for the evolution of human societies. Archaeological evidence concerning North America and Australia suggests that large-scale collective behaviour was geographically widespread. Prehistoric societies often collaborated in the group unit for the manufacture of communal goods, which was an indispensable element of the subsistence economy.

## 5. Conclusion

This study argues that human collaboration is a social choice based on a good collaborator's reputation within a logic of mutually beneficial cooperation and interdependence. Tribes that win cultural and resource battles can combine their productive brains to become large-scale cooperative communities. In order to preserve cooperation, people must consider the social repercussions of their actions as well as the tasks and advantages of cooperation. Social collaboration can be fairer by combining social norms and partner selection models. The study supports the assumption that people cooperate to benefit themselves, not to aid others. The investigation gave intuitive visual evidence for the origins of collaboration through human ancestral life, unlike recent studies and derivations. It suggests that cooperative evolutionary models and archaeological evidence may be able to explain human cooperation. Humans have lived on Earth for a very long time, yet much prehistoric archaeological evidence has been destroyed by natural calamities, descendants, or buried in the stratigraphy. Using current archaeological evidence and proofs, it is difficult to create a complete history of human cooperative evolution. Archaeology can provide material evidence for ancestral cooperation evolution, but it is simply auxiliary research. A cross-national study using multidisciplinary findings is needed to build a theoretical framework for human collaboration.

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