

# Egalitarian revolution in the Pleistocene?

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Although anthropologists and evolutionary biologists are still debating this question, a new study, published in the open-access journal *PLoS ONE*, supports the view that the first egalitarian societies may have appeared tens of thousands of years before the French Revolution, Marx, and Lenin.

These societies emerged rapidly through intense power struggle and their origin had dramatic implications for humanity. In many mammals living in groups, including hyenas, meerkats, and dolphins, group members form coalitions and alliances that allow them to increase their dominance status and their access to mates and other resources. Alliances are especially common in great apes, some of whom have very intense social life, where they are constantly engaged in a political maneuvering as vividly described in Frans de Waal's "Chimpanzee politics".

In spite of this, the great apes' societies are very hierarchical with each animal occupying a particular place in the existing dominance hierarchy. A major function of coalitions in apes is to maintain or change the dominance ranking. When an alpha male is well established, he usually can intimidate any hostile coalition or the entire community.

In sharp contrast, most known hunter-gatherer societies are egalitarian. Their weak leaders merely assist a consensus-seeking process when the group needs to make decisions, but otherwise all main political actors behave as equal. Some anthropologists argue that in egalitarian societies the pyramid of power is turned upside down with potential subordinates being able to express dominance over potential alpha-individuals by

creating large, group-wide political alliance.

What were the reasons for such a drastic change in the group's social organization during the origin of our own "uniquely unique" species? Some evolutionary biologists theorize that at some point in the Pleistocene, humans reached a level of ecological dominance that dramatically transformed the natural selection landscape. Instead of traditional "hostile forces of nature", the competitive interactions among members of the same group became the most dominant evolutionary factor. According to this still controversial view, known as the "social brain" or "Machiavellian intelligence" hypothesis, more intelligent individuals were able to take advantage of other members of their group, achieve higher social status, and leave more offspring who inherited their parent's genes for larger brain size and intelligence. As a result of this runaway process, the average brain size and intelligence were increasing across the whole human lineage.

Also increasing were the abilities to keep track of within-group social interactions, to remember friends and their allies and enemies, and to attract and use allies. At some point, physically weaker members of the group started forming successful and stable large coalitions against strong individuals who otherwise would achieve alpha-status and usurp the majority of the crucial resources. Eventually, an egalitarian society was established. Although some of its components are well supported by data, this scenario remains highly controversial. One reason is its complexity which makes it difficult to interpret the data and to intuit the consequences of interactions between multiple evolutionary, ecological, behavioral, and social factors acting simultaneously. It is also tricky to evaluate relevant time-scales and figure out possible evolutionary dynamics.

A paper published in *PLoS ONE* today makes steps towards answering these challenges. The paper is co-authored by Sergey Gavrilets, a

theoretical evolutionary biologist, and two computer scientists, Edgar Duenez-Guzman and Michael Vose, all from the University of Tennessee, Knoxville.

The researchers built a complex mathematical model describing the process of alliance formation which they then studied using analytical methods and large-scale numerical simulations. The model focuses on a group of individuals who vary strongly in their fighting abilities. If all conflicts were exclusively between pairs of individuals, a hierarchy would emerge with a few strongest individuals getting most of the resource. However, there is also a tendency (very small initially) for individuals to interfere in an ongoing dyadic conflict thus biasing its outcome one way or another. Positive outcomes of such interferences increase the affinities between individuals while negative outcomes decrease them. Naturally, larger coalitions have higher probability of winning a conflict.

Gavrilets and colleagues identified conditions under which alliances can emerge in the group: increasing group size, growing awareness of ongoing conflicts, better abilities in attracting allies and building complex coalitions, and better memories of past events.

Most interestingly, the model shows that the shift from a group with no alliances to one or more alliances typically occurs suddenly, within several generations, in a phase-transition like fashion. Even more surprisingly, under certain conditions (which include some cultural inheritance of social networks) a single alliance comprising all members of the group can emerge in which resources are divided evenly. That is, the competition among non-equal individuals can paradoxically result in their eventual equality.

Gavrilets and colleagues argue that such an "egalitarian revolution" could

also follow a change in the mating system that would increase father-son social bonds or an increase in fidelity of cultural inheritance of social networks. Interestingly, the fact that mother-daughter social bonds are often very strong in apes suggests (everything else being the same) that females could more easily achieve egalitarian societies.

The model also highlights the importance of the presence of outsiders (or "scapegoats") for stability of small alliances. The researchers suggest that the establishment of a stable group-wide egalitarian alliance should create conditions promoting the origin of conscience, moralistic aggression, altruism, and other cultural norms favoring group interests over those of individuals. Increasing within-group cohesion should also promote the group efficiency in between-group conflicts and intensify cultural group selection.

"Our language probably emerged to simplify the formation and improve the efficiency of coalitions and alliances," says Gavrilets. The scientists caution that one should be careful in applying their model to contemporary humans (whether members of modern societies or hunter-gathers). In contemporary humans, an individual's decision to join coalitions is strongly affected by his/her estimates of costs, benefits, and risks associated as well as by cultural beliefs and traditions. These are the factors explicitly left outside of the modeling framework.

In humans, a secondary transition from egalitarian societies to hierarchical states took place as the first civilizations were emerging. How can it be understood in terms of the model discussed? One can speculate that technological and cultural advances made the coalition size much less important in controlling the outcome of a conflict than the individuals' ability to directly control and use resources (e.g. weapons, information, food) that strongly influence the outcomes of conflicts.

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