

The Expansion of Eusociality: From Bees to Human Beings

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Abstract

Nowadays, the core characteristics of eusociality are challenged by species diversity. To conceptually unify studies of the eusociality of arthropods, vertebrates, and mammals, this paper proposes irreversible loss of totipotency as an indicator of eusociality. The irreversible loss of totipotency is reflected in arthropods and some mammals as morphological differences among castes, but considering artificial tools and devices as epitaxy of organs, morphological differences can't be transferred to the evolutionary process of human society. We argue that the division of ideas replaces the division of morphology in human societies. Therefore, we introduce meme reproduction to expand the definition of eusociality and propose an ideologized eusocial system.

1. Introduction

Nowadays, eusociality has a loose and restricted definition. The core characteristics of eusociality are challenged by species diversity, which is necessary to explore the boundaries between various social systems and to determine the stable characteristics of eusocial systems. To conceptually unify studies of eusociality of arthropods, vertebrates, and mammals, this paper will first review the history of changes in the definition of true sociality and propose an indicator for determining whether a species is eusocial, and then apply this indicator to mammalian as well as human societies[1]. The classical definition of an eusocial system comes from Michener, who argued that eusociality comprises three qualities: (a) The division of labor. Some castes may be sterile. (b) Various generations in the hive or nest (c) cooperative work for the children. In the very beginning, this classification was a specific description of the bee social system. Michener's terminology was expressed more completely and extended to other social insects as well. However, it is not appropriate when researchers extend this classification from arthropods to vertebrates and mammals[2]. Due to the existence of discretely different social systems among vertebrates, mammals, and arthropods (e.g., modes of production that perpetuate species' survival), the direct transfer of true social characteristics of arthropods to other species can cause confusion. For example, researchers attempt to employ a single variable, the "index of reproductive skew", to quantify the degree of unequal partitioning of reproductive output among individuals and separate alloparental care systems (i.e., eusocial systems) from other social systems[3]. Some critics argue that this single indicator does not take into account the different types of alloparental social systems in nature and thus fails to identify the most directly indicative of variation among species in selection on social behavior and whether societies form clusters or vary continuously along some axis or axes. For instance, parasites and predators have the same social system but little or nothing to do with social interactions. These two populations possess different indices of reproductive skew because many individuals of one population succumb to disease and are included as nonbreeders in the skew composition, which weakens the validity of the indicator.

2. Expansion of Eusociality Based on Morphological Differences

To alleviate the tension between the different social traits of arthropods and vertebrates, some researchers have placed the core of true sociality on the deep division of labor within species and the irreversible loss of totipotency. This division of labor is reflected in the division of the reproductive class and the sterile class in reproduction, and thus socialized parenting appears. In which, some castes as helpers have lower lifetime reproduction and they help others to reproduce. In addition to the field of reproduction, a refinement of the division of labor in the field of general production activities has occurred (e.g., the soldier class and the working class)[4]. Another important characteristic of eusociality is irreversibility. The division of labor is permanent, meaning that individuals become fixed into one of the castes (i.e., behavioral groups) at some point prior to reproductive maturity and there are no transitions between classes[5]. The sterile soldier class may, in some cases, perform the tasks of the working class but never become a breeding class. Thus, the criterion for the division of different castes within a population is the area of non-overlapping behavior of individuals with respect to each other[6]. In other words, the irreversible loss of totipotency in individuals belonging to a certain caste implies that they are genomically intact and would have had the potential to express all the abilities of all the castes in their population, but they have lost this opportunity over a long period of evolution. For arthropods and vertebrates, this permanent division of labor is based on the huge morphological differences within the population, and the differences in morphological characteristics between different classes or types of work within the population are even greater than the differences between this animal and other animals. For example, worker ants are much smaller than soldier ants, and there are huge differences in morphology, but the differences between different species of ant workers may not be very large[7]. Therefore, researchers often use morphometric methods to determine whether a population is eusocial. For example, researchers find the eusocial characteristics of termites due to the fact that morphological specializations of the different termites castes from Burmese amber. However, the limitation of morphometric methods is that only small morphological populations can be examined since the co-occurrence of the corpses must be required to find significant intra-population polymorphic differentiation. This means that if individuals within a population are fairly dispersed (e.g., relying on information technology or hypermobility), it is difficult to examine them as a community. Under the guidance of morphometry, human beings need to modify the body through genetic engineering projects to obtain morphological differences, so as to form a class of savage and strong soldiers, we can find such examples in science fiction (e.g., Warhammer Fantasy novel and HALO, etc). But for humans, this arthropod-based morphometry is dogmatic, stemming from two points. First, technology and devices have become extensions of our organs. Telescopes, microscopes, and wearable VR devices can expand our field of vision without having to remove our eyeballs. Humans also have enough, but the development of science and technology has created combat equipment that makes the evolution of our physical force insignificant. There is no difference between attacking strong men and dwarfs with hot weapons, so the soldier class created by the difference in shape is not suitable for human beings. In the future, with the development of the division of labor, it will take a lot of time to use certain tools, and this difference in time investment (i.e., specific assets investment) will form an irreversible division of labor[8]. Second, the core difference of human beings lies in inner thoughts rather than outer forms. The academic world should develop a new thought measurement method. This assumption is based on the assumption that the core of human thought will not change drastically after it is formed, so it is feasible to divide the sappers' class in thought. Moreover, thoughts can be governed by mind control technology (the media's propaganda of ideology). Although it is not completely deprived of the ability to think

freely, if it can greatly affect the decision-making of individuals, humans can also form a mechanism similar to the Zerg. This fits the description of the real society.

3. Expansion of Eusociality Based on Environmental Similarity

Early views held that eusociality existed only in arthropods, but zoologist Richard Alexander predicted that eusociality could also exist in mammals based on basic principles of evolution. The basic principle of evolution theory holds that as long as the living environment of this mammal is similar to that of eusocial organisms (such as termites), then it is likely to converge and evolve corresponding forms of eusocial organization. Therefore, rather than predicting a species, it is better to predict a living environment[9]. This environment is, first of all, a very safe but expansive den, which would otherwise not be able to protect large-scale pup production and accommodate the increasing number of groups; second, an adequate supply of food, which ensures that there will be no intense competition within the population; third, Alexander predicted that the nests of eusocial vertebrates cannot be built on or in trees like the nests of bees and ants, because no tree can be large enough to accommodate a eusocial vertebrate colony[10]. This kind of nest can only be completely buried in the ground. Of all vertebrates, only mammals can live completely underground (none of amphibians, reptiles, and birds). Rodents are the most likely mammals living underground, so eusocial vertebrates are most likely rodents. Ordinary underground rodents (e.g., moles) feed on grass roots, but the amount of this food is too small to support the population size required by true social animals. Therefore, eusocial mammals should feed on large roots or tubers. A few predators (e.g., snakes) will be able to burrow into their underground lair, but it is not possible to run rampant there, terrain factors and the altruistic behavior of one or more heroic individuals (as the lair is full of relatives) to drive out the invaders go out[11]. Not long after Richard made his predictions, he was told that researchers had found the burrowing rodent, later known as the naked mole-rat, in the Horn of Africa and parts of Kenya, especially in Somalia. This method of using descriptions of living environments as clues to inference suggests that humans may also become eusocial animals[12].

4. Expansion to Generalized Fitness: Memes and Eusociality

The formulation of generalized fitness based on kinship relatedness between actors and behavior recipients favorably explains biological altruism and thus serves as a foundational theory of eusociality. We can find that the consistency of eusocial species lies in the fact that the kinship of the investigated population is higher than that of other populations, which cannot explain the eusociality of human societies. We introduced memetic breeding to resolve this contradiction, but we still cannot ignore the coexistence of nepotism and memetic altruism in human society. A meme is considered a cultural transmission unit or imitation unit. Genes replicate using the self as a template, and memes replicate themselves through imitation. But it shares similar characteristics with genes (e.g., longevity, fecundity and self-replication). Memes also compete with each other like genes, occupying each other's survival resources (cognitive resources)[13]. The phenomenon behind our theory is that we can observe people dying for their families as well as for beliefs. Although there is a link between this belief and blood, the ability to organize based on belief is something blood cannot create. Thus, when we talk about complex organization, we are not only talking about the basic sociological unit of the family, but also about various religions, myths, and ideologies. From a memetics perspective, all values, morals, traditions, and ideas related to God and human rights are simply products of memetic evolution [14]. Memetic evolution is determined by the genetic predispositions of humans themselves, which in turn influence human sexuality. For example, beliefs and religions, long-standing and enduring religions, evolved from memes suitable for survival [15]. A large number

of people who do not know each other, as long as they believe in a certain religion or a certain ideology, can cooperate on a large scale. Now religion and myth have given way to the state, the more deceptive judicial system [16], the common consciousness of the state community, but these are only concepts of intersubjectivity [17]. We believe that it is not possible to directly apply the eusocial characteristics of arthropods and specific mammals to human society. First, in the narrow sense of true sociality, the clergy of some religions have given up the opportunity to raise offspring and become infertile. Second, if we consider the irreversible division of labor, the permanent loss of omnipotence, as a central feature of true sociality. We believe that the irreversible division of labor in human thought is more in line with the definition of true sociality than the occupational division of labor that is no longer easy to change. This division of thought forms a community of thought based on a particular belief [18].

5. Conclusion

This article reviews the differences in how eusociality is defined across species. Different assessment criteria should apply to arthropods, mammals, and human societies. This article points out that the core feature of true sociability is the division of fertile and sterile classes, but it can be extended to permanent division of labor between castes and loss of totipotency. In addition, based on Hamilton's Law, we believe that memetic reproduction will become an important indicator of true sociality based on the division of labor.

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