SOCIAL ORGANIZATION OF ANTS AND HUMANS

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INTRODUCTION

In the broad context of the science of ethology ants occupy an unusual place. Most studies focus on vertebrates, especially primates, due to their physiological similarity to man. This study focuses on ants because of their socialsimilarity to man. Ants have the adaptability to live in almost any environment and tend to dominate any environment in which they live. Man is the only other animal species of which this may be said. In addition, the ant is truly a social insect. Of all insects, the ant is the most manlike in behavior and the most adaptive. Some other insects form inflexible societies, but ants show great variation in behavior and social organization, even within the same species. And most interesting is the fact that the patterns of social and biological evolution of ants are parallel. As the physiology of ants evolved there was a parallel evolution in social organization. Since many of the 4000 species of ants represent evolutionary atavisms, this pattern of parallel evolution may be seen, not just reconstructed. Therefore, study of ant evolution may provide clues to the study of human evolution--both physiological and social.

THE EVOLUTION OF ANT ORGANIZATION

Ants first appeared during the Mesozoic period, evolved from a roach-like insect whose ancestory can be traced to worms. These first ants were primitive flying creatures, solitary in nature, and similar in appearance to a dragonfly. The female of this species laid her eggs in a relatively safe place and then disappeared and quickly died. The young were born fully developed and completely self-sufficient. No form of society or organization existed at this stage in ant evolution. Further along the evolutionary line ants started flying less and walking more. The decrease in use of the wings led to an increase in life span due to the conservation of energy. This increase in life span led to a situation in which the mother lived long enough to provide some care of her young. This represents the first major step in ant social evolution.

The second major step in ant evolution occured when a brood began to stay together. This allowed the development of a group based on patterns of association among the members. The entire structure of ant organization has been built on the stability of this elemental group. Here the parallel to the development of human society is apparent. Initially, the mother lived only a few days after her young had hatched. Eventually, she lived to see her young develop into mature forms. Finally she lived long enough to raise and care for more than one generation of young. This picture of primitive ant organization is not one which is reconstructed, but one which is observed. This behavior is typical of the scoliid, a living Neanderthal ant.

The third stage in the evolution of any society was the development of polymorphic ant forms. The initial development was the disappearance of wings on all but sexual ant forms. The worker ant had no wings, was sub-fecund (all worker ants are female, but are incapable of reproduction; they are non-sexual forms but are not neuter), and had a smaller body form. The evolution of worker ants was a function of the need for specialized forms to fulfill specialized needs of the group. As the life span of the mother increased and she lived long enough to see several generations of young, the mutual interdependence of the mother and the young increased. Sexual activity by the young would tend to reduce this interdependence and the association patterns of the group. As ants become sexually active they will leave the group, therefore the size of the group would be limited. The emergence of asexual forms allowed for increases in group size and complexity, and allowed for stronger association patterns among the members of the group.

Through this stage in ant evolutionary development, all ants had been carnivores. This resulted in frequent migration of the ant group in search of food. However, a nomadic life is mutually exclusive with the development of a complex social organization. If an ant society if going to maintain a progressive society and still remain carnivorous, the ants in it must be super-ants, capable of quickly and effectively killing a large number of other insects and returning

with them to the nest. However, the super-ant is a self-limiting process. A complex social organization cannot be built from the sum of many great individual endowments, rather, it must be built on the basis of an expanding division of labor utilizing not the individual abilities of super-ants, but the skilled specialization of a great number of worker ants. The final step in the evolution of ant organization, which paved the way for the transformation of ant groups into complex social units, was the development of non-carnivorous ant species.

The herbivorous ant species was characterized by greater polymorphism among the workers and longer life for the mother--who may be called the queen. The queen lived long enough to outlive many generations of her children, thereby increasing the stability of the group--which now may be called a colony. This increase in stability has led to the creation of the complex ant societies which are present today. A fully developed ant colony may contain up to 500,000 members, classified into several polymorphic stages, with several queens.

An ant society is completely dominated by females. The male ant never underwent the evolutionary changes outlined above; they are mirror images of the primitive, winged ancestors of the modern ant. The only function of the male ant is to mate with females. After performing their one task in life, they die. At all other times, male ants are parasitic to the colony.

THE SOCIAL ORGANIZATION OF THE ATTA ANT

We will now examine the social organization of a highly evolved species of the myrmicine family, to illustrate the parallels between ants and human social organization. A well developed atta colony consists of several underground chambers which may get as large as a man. The whole colony can fill a space of 6000 cubic feet. The mature colony is characterized by great polymorphism, based on the division of labor. Ants range in size from the huge soldiers, nearly as large as the queen, to tiny minims, only one one-hundreth the queen's size.

Atta ants are mushroom growers. The chambers for mushroom growing are located deep underground. Since the mush-rooms never see light, they do not develop caps but remain in fungus form, which is planted on the ceiling of the chambers and grows downward. The fungus is fed a paste consisting of chewed leaf mulch. The leaves are gathered by a specialized worker called a leaf cutter. These workers leave the colony every day and cut leaves, chew, and pre-digest them. They return at dusk and transfer the leaf paste to gardener ants who feed the paste into the fungus gardens. These gardener ants also cultivate and weed the garden. The underground chambers in which the fungus is grown provides an environment suitable for the growth of many forms of fungus and mold. Atta ants, however, have a diet restricted to only one kind of fungus. An analysis of the fungus gardens will reveal only the one kind of fungus, and gardener ants keep all other "weed" fungi out of their garden.

Young atta ants are completely helpless at birth. They must be fed and tended until they are mature. This is the job of the nurse ants. In addition, the nurse ants have the important task of determining which eggs receive the various amounts of food and hormone-like secretions which determines their polymorphic form. The nurse ants, therefore, have the responsibility for determining the colony's composition.

The soldier ants have the responsibility of tending and protecting the helpless queen. In addition, some soldier ants serve as leaf cutters, but this occurs only when there is an excess of soldier ants. Finally, some males are maintained by the colony in an immature form.

ANT BEHAVOR AHD SOCIOLOGICAL THEORY

An examination of the atta colony demonstrates the true social nature of ants. First a specialized division of labor is present which serves as the source of functional interdependence which maintains the colony. In fact eight different "occupations" of atta ants exist in a mature colony. They are the queen(s), nurse ants, soldier ants, leaf cutter ants, gardener ants, immature male, immature female, and immature worker ants. In addition the concept of social stratification may be viewed in an ant colony. There is a hierarchy of positions, graded in ranks. The queen is obviously the top rank, immature males occupy the bottom ring of

the stratification ladder. Since the position of an ant is determined at birth, social mobility is (with one exception) impossible. The individual ant has her station assigned at birth. We may therefore classify ant society as a caste system. Like the original caste system of India, the ant caste system is based on the division of labor.

Further examination of an ant colony on a macro level reveals another interesting phenomena. All colonies evolve from those which are small, homogenous, and poorly developed. We could say that they are held together by a kind of "mechanical solidarity", based on the physiological similarities of members. They evolve into large, heterogeneous and well organized colonies with a well defined division of labor. We could say that these colonies are held together by an "organic solidarity" based on the division of labor or physiological diversity of members. This is, of course, a play on Durkheim's model of social change. Durkheim stated that the change from mechanical to organic solidarity was accompanied by an increase in the division of labor. In other words, changes in social organization are interwoven with changes in culture. Yet these changes come about from changes in moral density, itself a consequence of increasing population. The increase in moral density accompanying the evolution from mechanical to organic solidarity forces individuals to cooperate with one another, increasing functional interdependence.

The history of ant social evolution is in many ways parallel to the history of the development of human social organization. Primitive ants could be classified as having a hunting and gathering type of substance organization based primarily on the ability of the isolated ant to meet his own needs. Primitive ants were born wholly self dependent; and all ants were the same in terms of form, function, and genetic mapping. The process of ant evolution was one of increasing interdependence and increasing heterogeneity of ants. The increase of polymorphic ant forms allowed for the development of mutual interdependence and division of labor. We may say that due to biologic evolution ants changed from a social organization based on mechanical solidarity to one based on organic solidarity because of an increase in the division of labor.

The main difference between the evolution of human and ant societies is in the origin of the impetus of "force" which pushes them. This really is based on the mechanisms by which ants and men acquire knowledge. Men acquire knowledge primarily through socialization and secondarily through instinct or genetic mapping. Insects acquire knowledge primarily through genetic mapping and secondarily through socialization. The increase in division of labor in ant societies is dependent on the changes or evolution in genetic mapping. In human societies, the division-of-labor is something which is learned and transmitted socially. Although the mechanism differs, the consequences are similar: new roles are acquired and social organization changes as a consequence. Finally, in both men and ants there is an interplay between instinct and learning.

An interesting aspect of the social nature of ants is that ants work better in association with other ants than alone. In addition, ants who are slow workers undergo marked improvement when working in association with ants who are fast workers. Finally, ants working in association tend to have greater uniformity in behavior than isolated ants. This certainly represents ant socialization. In human societies, a similar set of behavior would be labeled imitation and/or rivalry. While these terms will not be applied to ant behavior, this aspect of ant behavior clearly shows a social nature.

A NOTE ON THE METHODOLOGIES OF ETHOLOGY AND SOCIOLOGY

In recent sociological research the methodological approach taken has been to examine a large number of subjects with the goal of trying to identify or classify a few general patterns of behavior. Ethology represents a marriage of field work and comparative zoology. As such, ethology is concerned with the intensive examination of a few subjects in order to identify patterns of behavior. In this paper, references have been made to the similarities in social organization and behavior between human and infro-human organization. If this similarity does exist, there can be a marriage of sociological and ethological research methods with beneficial results. While this paper does not pretend to determine if either method is better, certain aspects of ethology do make it extremely

useful for the study of human behavior. The main advantage of ethology as a research method is that the ethologist cannot talk to his subjects. In sociology the predominant means of obtaining data is by use of either the interview or questionnaire. Both sources of data are subject to contamination both from the researcher and respondent. The problems of validity, reliability, reactivity, self-selection, interviewer bias, etc. are well known to all students of sociology. We put up with these problems because of the relative ease of the interview or questionnaire compared to bare observation. Although we pay lip service to the problems of validity and reliability and problems created by the use of instruments, we really do very little to overcome these problems. More often we resort to the expedients of indexes, scales, experimental design, or statistical analysis. In addition, interviews, questionnaires, and participant observation all produce reactive measurement effect--error produced by a respondent because he knows he is being studied. While some efforts, usually only token efforts, are utilized to eliminate or compensate for reactive measurement effect, in most research projects the investigators have no idea the extent to which their presence invalidates the subject's responses. Finally, limits of time and cost dictate use of an imperfect sample in most research projects. While most students are taught that only random samples produce results which allow for generalization; an examination of sociological literature clearly reveals that the most common method of selecting samples for research studies is based on the criteria of convenience. The combination of these three sources of error; poor instrument design, reactive measurement effect, and poor sample design dictates extreme caution in the interpretation of any sociological research results.

On the other hand, the findings of the ethologists are rarely questioned. Can it be that the philosophy of observation, classification, generalization provides better results. However, this philosophy is that of inductive research, a methodology embraced by sociology. The problem lies in the assumptions the sociologist, (as compared to the ethologist), makes about the subjects. The sociologist assumes knowledge of his subjects, sets up classifications of behavior, and notes which subjects fall into these categories, rather than the other way around. Second, many sociologists feel that the classification of behavior does not constitute research. Rather the sources and causes of these behaviors must be studied. Many of these causes of behavior; such as motives, attitudes, and interests, cannot be directly observed or measured. Therefore, the sociologist creates scales and interview schedules to try and measure these hypothetical constructs. But, the general patterns of behavior, for which the sociologist is trying to show the causes, are still not clearly understood. The result is that sociologists try to explain vague patterns of behavior or even isolated instances of behavior as due to causes which have low levels of validity, reliability, or generalization.

Ethologists make no such assumptions about the population they study. Perhaps their only assumption is that the species will try to survive. They try and perceive generalized patterns of behavior in the particular species being studed. Because they cannot talk to their subjects they must be content with observation as the method of research. Consequently, there is no problem of instrument validity or reliability. In addition, etholgists may act as if they were part of the environment in which their subjects normally behave. Consequently he has no problems with reactive measurement effect. Finally, the ethologist investigates only general patterns of behavior in depth, and has no problem with sampling. A sample can be identified on the basis of system boundary and it can be studied in depth. If the patterns of behavior are really general then they should be applicable to any other bounded system. Variations in behavior will require reclassification and re-examination.

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transcend the concrete self. Contemplation, conversely, has as an object the condition humaine. As Bell states: "to forego the 'representation' of another, is not merely to forego a text; it is to deny the commonality of human experience..." (1976 133). In short, modernism does not trigger reflection on the place of the individual within the cosmos, or relate personal experience to those experienced by other human beings, whether relative to one socio-historical period or across time and space, but rather stimulates and shocks the self in an immediate and intense fashion.

The rise of sensibility as an organizing principle for aesthetic experience has reached its pinnacle with the "visual arts": "The very technique of the new arts, principally cinema and modern painting, act to eclipse the psychic and aesthetic distance between the viewer and the visual experience..." "This central aspect of modernity--the organization of social and aesthetic responses in terms of novelty, sensation, simultaneity, and impact--finds its major expression in the visual arts." (Bell 1976 106-107).

CONCLUSION

The Bell-Sennett thesis is a very formidable position. There is considerable evidence suggesting that aesthetic experience, aesthetic creation and aesthetic content have in general become more private and self-centered in nature. Their thesis, then, is accurate in its description and portrayal of general and aesthetic trends over the course of recent centuries. However, the privatization thesis, in our view, suffers from two major inadequacies.

First, both Bell and Sennett assume the existence of an isomorphism between the aesthetic realm and the total culture. While it may be the case that the aesthetic realm is "privatized", that does not necessarily mean that a precise symmetry exists between art and society. The strategy of deducing aesthetic privatization from the more general privatization of modern consciousness is questionable in the light of the considerable autonomy of institutional spheres characteristic of modern societies. The extent to which the arts ought to be singled out for attention as being particularly indicative and supportive of a more generalizable cultural trend is problematic.

Second, the thesis, in focusing on a modal type, fails explicitly to recognize the possibility of a multiplicity of aesthetic processes and forms. It generalizes to the aesthetic realm as a whole a preoccupation with the self and "personality" which in fact is more characteristic of certain subgroups in that realm. That is, there are varying degrees of aesthetic privatization depending on 1) social location within the society, by social class, or religion; 2) social location within the aesthetic realm, as artists, audience, or sponsor; and 3) the nature of the aesthetic situation.

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