

An anthropological investigation into insect societies in classical evolutionism

James William^{1, a}, Ashley Smith^{1, b, *},

¹One Prospect Street, Providence, Rhode Island 02912, United States
a.james_william_jw@outlook.com, b.ashley_smith_6158@126.com

***Corresponding Author**

Abstract: Within the theoretical development of classical evolutionism, the study of "insect societies" constitutes a widely and thoroughly discussed topic. Renowned scholars including Darwin, Huxley, Bachofen and Bergson conducted insightful explorations of this issue from distinct perspectives, generating a range of illuminating theoretical reflections on social division of labor, morality and ethics, matriarchal society, and creative evolution. Clarifying studies on insect societies in classical evolutionism is essential and pivotal for us to comprehend the construction of social theories within the humanities of that era.

Keywords: Evolutionism, Insect Societies, Classical Evolutionism, Darwin, Huxley, Bachofen, Bergson

1. Introduction

This paper centers on the comparative research between insect societies and human societies from the perspective of classical evolutionism, systematically sorting out relevant theoretical achievements of four core scholars: Darwin, Huxley, Bachofen and Bergson. It first clarifies the birth background, core viewpoints and research paradigms of classical evolutionism, and identifies the central role of comparisons between insect and human societies in the construction of early social theories. Then it respectively analyzes Darwin's research on the instinct evolution of bees and ants in *On the Origin of Species*, Huxley's theory of ethical social evolution, Bachofen's metaphor of matriarchal society reflected in beehives, as well as Bergson's Creative Evolution and his thoughts on social differentiation, and compares the distinct interpretations of the relationship between insect societies and human societies put forward by these scholars. The study reveals that researches on insect societies within classical evolutionism extend from biological evolution to social theory, enriching the theoretical system of early human society and offering crucial theoretical references for understanding the moral nature, openness and creative development of human society.

2. Research on classical evolutionism and insect societies

2.1. The birth of classical evolutionism and its interdisciplinary influences

Classical evolutionism constitutes the first disciplinary paradigm in the history of anthropology. As early as 1801, Jean-Baptiste Lamarck, a French naturalist, explicitly put forward the concept of biological evolution. Nevertheless, evolutionary theory drew widespread public attention only after the publication of Charles Darwin's *On the Origin of Species* in 1859. Darwin's evolutionary theory sent shockwaves through academic circles of the era, dismantling various idealistic creationist doctrines and delivering a severe blow to Christian theology. Beyond biology, evolutionary theory exerted extensive and profound influences on anthropology, philosophy psychology and other disciplines of the time. Ultimately, it replaced creationism and catastrophism as the prevailing explanation for the origin and variation of organisms. Rather than the speculative arguments grounded in subjective perception and mythological interpretation that preceded it, evolutionary theory pioneered the construction of an objective, comprehensive and grand knowledge system. Friedrich Engels even ranked evolutionary theory among the three major discoveries of natural science in the 19th century.

2.2. Core views and biological research of classical evolutionism

Classical evolutionism holds that organisms evolve from lower to higher structures, from simpler to more complex functions, and from fewer to more diverse species through heredity, variation and natural selection. Influenced by this theory, researches on living creatures in natural sciences and humanities of that period adopted diverse approaches, which can be generalized into three categories. First, research on primates. Triggered by their physiological similarities to human beings, such studies mainly explore the connections between primates and humans and examine whether primates possess culture. Second, research on insects, especially investigations into insect societies that bear partial resemblances to human societies, such as comparisons of labor division between ant colonies, bee swarms and human societies. Third, research on human beings themselves, covering human origins, physical characteristics, society and culture. Therefore, within the research framework of classical evolutionism, studies on the evolution of humans, culture and society inevitably involve observations of other primates, lower animals and insects. Scholars explored whether these primates, lower animals and insects possessed "societies" or "organizations" analogous to those of humans, and whether such social forms existed prior to the emergence of human societies. These inquiries were critical to the construction of social theories in early humanities disciplines.

2.3. Insect-Human social comparison in classical evolutionism

In the researches of classical evolutionism, the comparative analysis of insect societies and human societies attracted special attention from many scholars of that era; besides Darwin, Huxley, Bachofen and Bergson also delivered dedicated discussions on this subject along evolutionary research lines. All these scholars lived in the evolutionary age, and their thoughts and studies were more or less associated with evolutionism and researches on insect societies. As later scholars summarized: "The emerging discipline of sociobiology insists that *Homo sapiens* is an indispensable part of nature, and theoretically speaking, *Homo sapiens* should be regarded as a social animal. There are numerous other examples of such social animals in nature — social insects, social mammals such as wolves, and social primates." [2] Hence, comparing "insect societies" with "human societies" constituted a major method for constructing social theories under evolutionary thought at that time. Among abundant evolutionary studies concerning insect societies, examinations of societies within beehives and ant nests stood as core focuses, for bee colonies and ant colonies both possess human-like social organizations featuring the phenomenon of "labor division".

3. Insect societies in on the origin of species

3.1. Darwin's definition of instinct and preliminary studies on bees

In *On the Origin of Species*, Darwin conducted in-depth investigations into a wide range of animals, plants and insects, with his research on bees and ants concentrated in the chapter titled "Instinct". Darwin defined "instinct" as follows: "An action, which we ourselves require experience to perform, when executed by an animal, especially a young one, without any experience, and when many individuals perform the same action without knowing the purpose for which it is done, is generally called an instinct." [1]

The first discussion concerning bees in *On the Origin of Species* stems from Darwin's exploration of whether instincts are subject to variation. At that time, observations showed that bees did not diligently gather tree wax but instead utilized a mixture of wax and turpentine scraped from peeling bark. Other records indicated that bees avoided pollen collection and preferred a distinct substance, oat flour. [1] These observations of bee behaviors demonstrate that instincts vary to a certain extent under natural conditions; any variation beneficial to a species may be preserved and passed down to offspring via natural selection, giving rise to new instincts. The second analysis of bees and ants appears in the section dedicated to "special instincts of organisms". After examining the cuckoo's instinct of laying eggs in other birds' nests, Darwin focused on ants' slave-making instinct and bees' hive-building instinct, which naturalists deemed "the most extraordinary instincts known to mankind".

3.2. Darwin on the instincts and evolutionary sequences of ants and bees

When describing the slave-making instinct of ants, Darwin made a specific comparison between two ant species: the *Formica sanguinea* and the *Formica rufescens*. Both possess the instinct to enslave other ants yet

exhibit distinct traits. *Formica rufescens* is incapable of building nests, planning migrations, gathering food for itself and its broods, or even feeding itself, relying entirely on vast numbers of enslaved ants for survival. By contrast, *Formica sanguinea* independently decides when and where to construct new nests, carries their slaves during migrations, and maintains only a small slave population, especially in early summer. [1] Darwin also studied ant species that do not practice slavery. Though such ants drag pupae of other species scattered around their nests, they initially rear these foreign ants unintentionally as a byproduct of food storage. Upon hatching, the captured ants retain their inherent instincts and only perform tasks suited to their nature. Assuming all variations benefit the species, Darwin outlined an evolutionary gradient based on the degree of reliance on enslaved ants: non-slave-making ants → *Formica sanguinea* → *Formica rufescens*.

When discussing bees' instinct of constructing hives, Darwin pointed out that most bees build nests inside dark beehives with extreme precision, ensuring structural stability while using wax in an extremely economical way. Based on the varying capabilities of hive construction among different creatures, Darwin mapped out an evolutionary sequence: humblebees, Mexican bees, and honey bees or wasps. He argued that honey bees and wasps construct cells that are not only sturdier but also save more labor, space and construction materials. This proves that different varieties within the same species possess divergent instincts. Natural selection operates solely through the accumulation of minor structural or instinctual variations, each of which benefits individuals under their living conditions, and by extension facilitates the survival of the entire group and the continuation of the species.[1]

3.3. Insect society research in *on the origin of species*: logic and limitations

In *On the Origin of Species*, Darwin's discussions of insect societies revolve around the evolutionary development of instincts driven by so-called "social division of labor". Particularly in his accounts of bees and ants, the existence of what he terms "insect societies" is clearly evident. Many noteworthy phenomena are highlighted here: for instance, ants bear obligations to members within their own nest yet display no sense of duty or sympathy toward ants from other nests or conspecifics; additionally, colonies rely on sterile neuter insects such as infertile worker ants and worker bees as the foundational support for group survival. It should be noted that Darwin's research on insect societies centers primarily on biological evolution, and such insect societies are egoistic in nature. In other words, the comparison drawn between insect societies and human societies in *On the Origin of Species* remains merely illustrative without establishing inherent logical connections between the two.

4. Discussions on social evolutionism and insect societies

4.1. The evolutionary vein and core connotations of social evolutionism

Social evolutionism has evolved alongside biological evolutionism. In the 18th century, thinkers embraced the idea of human progress within the framework of the immutability of species, while by the late 19th century, the modern conception of social evolution became linked to the notions of "the struggle for existence" and "survival of the fittest"[3] Therefore, although intellectual circles widely accepted the concept of progress long before the emergence of evolutionary theory, evolutionism undoubtedly brought this idea of progress to greater public prominence.

4.2. A comparative study of biological and social evolution in Huxley's works

4.2.1. Huxley's interpretation of biological evolution and the cosmic process

After elaborating on biological evolution in his magnum opus *Evolution and Ethics*, British philosopher Thomas H. Huxley drew illuminating comparisons between the theory of biological evolution and research on the evolution of human society. He held that social evolution differs from biological evolution, and evolution also encompasses degeneration. He pointed out that the state of nature is by no means permanent; on the contrary, temporality lies at its core.[4] Accordingly, what endures perpetually is not any particular combination of life forms, but the processes generated by the universe itself. Huxley stressed that one of the most typical manifestations of this cosmic process in the biological world is the struggle for existence, namely the conflict between every individual and its entire surroundings, which results in natural selection.

In other words, the life forms that survive are generally those best adapted to the various conditions prevailing at a given time.[4]

4.2.2. *Huxley's exposition of biological evolution and the cosmic process*

When discussing social evolution, Huxley put forward two characteristics of social evolution: the "natural personality", which refers to unrestrained self-interest, and the "artificial personality", meaning self-restraint that constrains the natural personality. Meanwhile, he proposed two corresponding concepts, namely the "cosmic process" and the opposing "horticultural process". The cosmic process operates through unrestrained reproduction, driving millions of creatures to compete for limited living space and scarce food. Frost and drought will eliminate the weak and unlucky individuals. Hence, survival demands not only physical strength but also resilience and good fortune. On the contrary, the horticultural process restricts reproduction, supplies each plant with sufficient space and nutrients, shields it from cold and drought, and optimizes living conditions in every possible way to preserve species that best meet the gardener's standards of utility or beauty.[4] At this point, evolution reflects functional demands centered on practicality or aesthetics, which shares striking similarities with human family planning for eugenics. This insight marks Huxley's advancement over Darwin, whose theory overlooked the horticultural process. Accordingly, evolution possesses not only natural and cosmic attributes but also artificial and horticultural attributes.

4.2.3. *Insect and human societies: a comparison and the ethical process theory*

When comparing insect (animal) societies and human societies, Huxley first emphasized their similarities. He argued that human societies, much like bee colonies, emerge out of the demands of social functions in their initial formation, which requires every social member to act in line with collective interests. Huxley then pointed out fundamental and stark differences between the two. In bee societies, each member is physiologically predetermined to perform a single specific function, whereas human societies impose no rigid preordained roles on their members. As stated in *Evolution and Ethics*, insects (animals) are confined to their predetermined modes of existence after the struggle for survival; humans, by contrast, impose self-restraints on their self-serving impulses after contending with nature, giving rise to a range of new faculties: pervasive sympathy, a sense of morality toward fellow humans that transcends disregard for communal welfare, compassion for both organic and inorganic nature, fear of peer judgment, and the formation of the "inner man" or conscience. This evolutionary progression of sentiments is termed the ethical process, which curbs the antisocial tendencies inherent in natural humanity within the bounds required for communal wellbeing. Huxley maintained that emotions stem from instincts, yet these instincts represent a deeper, elevated form compared to those described by Darwin. As he underscored: "When the ethical process has advanced to secure the means of subsistence for every member of the community, the struggle for existence between men in society will practically cease." [4] From Darwin's account of egoistic struggle in nature to Huxley's depiction of the gradual disappearance of conflict within human communities, evolutionary theory, through its comparison of insect and human societies, clearly reveals the formative power of ethics.

4.3. **Bachofen's beehive-based study on matriarchy**

4.3.1. *Core perspectives of Bachofen's comparative study on the beehive model*

In his work *Mother Right* (1861), J.J. Bachofen offered a detailed description and analysis of the beehive, arguing that it bore striking similarities to the matriarchal societies he examined in the book. Bachofen wrote: "The functioning of social organizations ruled by women in antiquity closely resembles the operation of a beehive, and numerous ancient writers took the beehive as a model for the development of human society." [5] Accordingly, Bachofen explicitly stated that his study of the beehive was intended to draw comparisons between insect societies and human societies. Admittedly, such an implicit comparative logic runs through the works of evolutionists including Darwin and Huxley, yet these scholars compared the beehive to human society as a whole, while Bachofen limited his comparison to a segment of human society, namely matriarchal society, a research approach that gave rise to an early form of structuralism. Bachofen contended in *Mother Right* that patriarchal societies emerged later than matriarchal ones, and the beehive constituted an organizational form analogous to early human society. He elaborated: "The beehive presents

a clear, unadulterated illustration of female governance. Every beehive has a queen, the mother of all its bees. Numerous drones attend to her, whose sole purpose is to fertilize the queen. The drones perform no labor; once they complete their reproductive function, they are killed by female bees. Thus, all bees within the hive share a single mother yet have countless fathers. These fathers receive no affection from the hive and contribute nothing to its maintenance. In fact, their own offspring drive them out or sting them to death, their demise inevitable once they have inseminated the queen. In contrast to the drones, the queen maintains a close, nurturing bond with the worker bees, who regard her as the source of their life and the core of their community. Chaos engulfs the hive upon the queen's death."[5]

4.3.2. *Core perspectives in Bachofen's beehive comparison research*

Mother Right also explores the symbolic connection between honey and women. Honey is a product of organic nature, which serves as the origin of all things, just as women are the source of human life. All these images act as metaphors for matriarchal society. Bachofen held that women rather than men served as warriors in primitive times, so metaphors drawn from insect societies constitute only a portion, rather than the entirety, of his discourse on matriarchy. His discussion also covers many other themes such as consanguineous killing and social division of labor. For instance, fratricide within a bloodline represents an altruistic act that may facilitate the formation of smaller social units such as families. Furthermore, Bachofen equates the labor division within beehives to that of human societies, especially matriarchal communities. In this way, the link between insect societies and human societies becomes further consolidated.

5. Insect societies in Creative Evolution

5.1. Overall innovative characteristics of Bergson's Creative Evolution

Although Bergson also acknowledged the similarities between insect societies and human societies, stating that "It is said that ants are masters of the underground, just as human beings are masters of the earth's surface."[6] Henri Bergson's theories in *Creative Evolution* are undoubtedly the most innovative and enlightening among all classical evolutionist doctrines, and his evolutionary theory differs drastically from the researches of prior scholars.

5.2. Bergson's evolution vs. traditional evolutionism

First of all, Bergson's evolutionary theory only addresses the evolution of organic beings. Earlier scholars such as Tylor, in his discussion of the concept of "survivals", believed that when one organism evolves into another, the original form vanishes into the past, and the new form exists independently while repeating the experience of its predecessor. Bergson, however, argued that the prior and subsequent forms are closely interconnected. All such organisms possess memory, and their present carries the past while unfolding toward the future; the organism can retrieve past memories when its own needs demand it. Moreover, Bergson held that inorganic matter merely serves as the constituent material of other objects and life forms and is not subject to evolution at all, which restricts his evolutionary discourse exclusively to organic entities.

Secondly, Bergson proposed a teleological orientation for life. He contended that the ultimate goal of life lies in the pursuit of volitional freedom: the nervous system differentiates itself from the motor system, liberating the will from material constraints to achieve freedom of will. In contrast, Darwin, Tylor and other scholars advocated a non-teleological view of life. Darwin, for instance, argued that species simply vanish once they become extinct, with their traces only recoverable through fossils. Similarly, Tylor put forward the concept of "survivals", which could only be discovered in societies less advanced than one's own. It is evident that both fossils and survivals merely embody the past, devoid of the present, let alone the future.

5.3. Bergson's world classification and social evolution of insects and humans

5.3.1. *Bergson's world division system and distinction of life attributes*

Lastly, Bergson's classification of the world merits particular attention, which interweaves his comparisons between instinct and intellect as well as explorations of concepts such as life's creation and

duration. Bergson divided the world into the organic and inorganic realms, and further split the organic realm into plants and animals. In his analysis of plants and animals, he argued that they adopt distinct feeding modes. Plants can directly convert substances from nature into nutrients, so they remain stationary with latent internal movement. Animals, by contrast, cannot transform natural raw materials directly into sustenance and must move to search for and acquire food. Animals are further categorized into Hymenoptera and vertebrates. Hymenoptera form animal societies yet stop evolving at the insect stage, while human beings represent the highest evolutionary tier of vertebrates. Analogies such as motion and rest, instinct and intellect coexist within plants and animals much like recessive and dominant genes in biology; whichever trait prevails depends on its proportion within a living organism, and each inherently contains the dormant potential of its opposite. Neither can be rigidly defined, for they stand merely as inherent tendencies whose dominance varies across individual life forms.

5.3.2. *Evolutionary differences: closed insect vs. open human societies*

Bergson held that the evolution of life branches into numerous divergent paths. Beside two or three major evolutionary thoroughfares lie countless dead ends, among which only one broad passage allows the main current of life to flow freely—the path leading from vertebrates to human beings. This explains the striking contrast observed when comparing bee or ant societies with human societies: bee and ant colonies operate in rigid conformity and tight solidarity yet remain perpetually static, whereas human societies embrace all forms of progress and constantly engage in internal self-transformation.[6] This comparison echoes his distinction between "closed societies" and "open societies". The reason why Hymenoptera live in a state analogous to closed societies probably lies in their bodily specialization: their tools are inherent parts of their own bodies, while vertebrates, especially humans, fashion tools from external inorganic matter. Human existence thus comprises physical existence and volitional existence. The body possesses memory, carrying the past into the future through the present, which gradually strengthens the nervous system until it differentiates from the motor system. The will then detaches from physical confinement to achieve independent volitional existence, fulfilling life's ultimate purpose: freedom of the will. Unlike Huxley, who regarded insect societies such as beehives as inferior to human societies, Bergson argued that these constitute two distinct types of societies, and insect communities serve as a complement to human societies. This is because evolution does not follow a single fixed trajectory; it radiates in multiple directions without predetermined goals, and it retains creative capacity even amid adaptive adjustments.[6]

6. Conclusion

From Darwin to Huxley, Bachofen and then Bergson, the researches of the above scholars all acknowledge to varying degrees that societies existed long before humanity, exemplified by insect societies, though some scholars imply this viewpoint subtly while others state it outright. Despite drawing certain comparisons between insect and human societies, these scholars examined insect societies within distinct theoretical contexts. Darwin, upon recognizing the complexity of insect societies, attributed such complexity merely to instincts shaped by social division of labor, describing insect colonies as egoistic communities and limiting his analysis purely to biological evolution. Huxley advanced beyond Darwin by extending the framework of biological evolution to the study of social evolution. Whereas Darwin only implicitly juxtaposed insect and human societies, Huxley systematically applied general evolutionary principles to human development, arguing that humans undergo an ethical process subsequent to the cosmic process, which fosters self-restraint, morality and compassion for others. Evolution thus shifts from Darwin's egoistic competition in nature to Huxley's self-sacrificing altruism within human communities, elevating evolutionary thought to a new plane. Bachofen bifurcated human society into matriarchal and patriarchal forms, asserting that matriarchy predates patriarchy, and contended that insect societies bear extensive similarities to early matriarchal human communities. Bergson deployed observations of insect societies to illustrate the divergent branches of animal evolution, separating Hymenoptera from vertebrates (above all humans). He argued that Hymenoptera entered an evolutionary dead end, while vertebrates attained their pinnacle in humankind, and delivered a thought-provoking analysis of the forces driving evolutionary divergence. These studies of insect societies within classical evolutionism enriched and perfected the social theories of the era. When explaining why human societies are vastly more complex than

insect societies, scholars not only drew comparisons of physiological structures but also elaborated on the normative value of social morality and the creative potential inherent to open societies.

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