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The effects of the modern
evolutionary synthesis on the
new organizational paradigm

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This paper discusses the connection between natural and social sciences through how the modern evolutionary synthesis approach, which emerged in biology, influenced social organizations. First, the paper examines the relationship of neo-evolutionism with organizational theories. Then the interaction between natural and social sciences is explained in the study. Afterwards, the relationship between neo-evolutionism and organization theory is handled around the discussions in this field. It has been emphasized that the flow of knowledge between sociology and biology is much more organic and mutual than expected. In other words, this study aims to draw attention to the methodological continuity of the interaction between evolution and organization theory from the very beginning to the present. In line with this purpose, the relationship between the transformation of the theory of evolution and the transformation of classical organizational theories is examined. In this study, it is claimed that the source of the paradigmatic interaction of neo-evolutionism and organization theories is the analogical relationship that began to be established between biology and sociology in the nineteenth century and that this relationship has turned into a much more organic structure than a mechanical and technical analogy in the historical process.

This article is part of the theme issue 'Thermodynamics 2.0: Bridging the natural and social sciences (Part 2)'.

1. Introduction

This article examines the relationship between neo-evolutionism and organization theories. It first explains the interactions between the natural and social sciences by explaining how the disciplines of biology and sociology relate to one another. The study then moves on to its primary focus, addressing the relationship between neo-evolutionism and organization theories, using the debates in the field and the theories that have been put forward. In this way, the study will clarify the relationship between the natural and social sciences and focus on how the flow of information between sociology and the biological sciences is much more organic and reciprocal than previously thought. In other words, this study aims to draw attention to the methodological continuity of the interaction between the theories of evolution and organization from past to present. To this end, we have determined the subject of discussion to be the relationship these two fields have had together in transforming evolutionary theory into a modern synthesis and transforming classical organization theories into new organizational models through the neo-evolutionism of the 1960s. Finally, this study argues that the source of the paradigmatic interaction between neo-evolutionism and organization theories is the analogous relationship that began to emerge between biology and sociology in the nineteenth century and that this relationship has transformed much more into an organic structure throughout its historical process than a mechanically and technically analogous structure.

This examination of this relationship is limited to the relevant developments in the theoretical discussions. Nevertheless, assessing the distinction between the natural and social sciences in the first section provides a significant basis for the study by illustrating how the sharp differences and deep interconnections between the two fields constitute a specific relationship for each period. This basis is essential as it ensures the interaction of scientific knowledge in the historical process through concrete structures and discussions and contributes to understanding the continuity of interactions among the modern synthesis, neo-evolutionism and social organization theories that surfaced in the 1960s and later.

The paper examines biology and sociology as examples from their respective natural and social sciences. In terms of this, the study will focus on the relationship between these two significant disciplines, as representatives of this distinction and in the ways they deal with the organization of life and humanity. In this regard, sociology uses biology as an analogous element of knowledge. It attempts to explain how modern society works by examining how people thought in the past. Moreover, because the studies and discussions in these two fields reveal how life and people are combined as a whole body of thought, they work in harmony.

The methodological and analogical exchange between biology and sociology began in the nineteenth century and continued along a similar trajectory in the following periods, albeit with revisions. As a result, interactions emerged among the theories of modern synthesis, neo-evolutionism and organization. These interactions constitute the second section of the study. At this point in the text, the methodology moves the subject from a general to a specific status while addressing the discussions. As such, the study will briefly mention the early orthodox evolutionist approach to illustrate the relationship between biology and sociology.

The study then reveals how viewing the results of the natural sciences from the perspective of the social sciences and viewing the results of the social sciences from the perspective of the natural sciences are now more than methodological choices. Thus, there is an intent to reemphasize the importance of updating sociological theory and views on social organization with the new approaches and data found in biology. This study contributes to the literature by mentioning a new field of analysis in which the relationship between biology and sociology takes on an organic rather than an analogous form.

2. The theories of evolution and organization in the nineteenth century

The conflict between the natural and social sciences was reshaped in the nineteenth century and each subsequent period. Nevertheless, whether through competition or consensus, the

interaction between the two branches of science has maintained vitality in each period. This division between these two modern sciences represents the organization of science. On the other hand, the efforts of both fields to make sense of their objects represent a kind of organizational analysis. Understanding how things are organized involves considering different objects using different methods and subjecting them to scientific identification and classification. Therefore, the differentiation of objects and methods appears homogeneous in viewing the mind to understand an organization. Nevertheless, the commonality of concerns and aims causes information to circulate as a transformative force between the two fields, with the spread leading to a transformative interaction between the fields. This interaction explains why the relationships between the natural and social sciences in the historical process have a dialectical character, one that both produces and is influenced by the paradigms of the knowledge of the time.

With the effect of the Enlightenment and the Industrial Revolution, the nineteenth century and the first half of the twentieth century exhibited a structure in which the scientific legitimacy of the natural sciences was the dominant paradigm. Therefore, the efforts of the social sciences to understand people and their societies had to follow natural methods to meet the requirements of this legitimacy. In other words, to prove the social sciences' sustainability, they would have had to show that objective, universal and scientific data exist in their methodology. As a result, the approach to discovering nature and determining its fundamental laws that occurred between the relevant centuries in the field of natural sciences saw the essential motives of modern man and society as discoverable structures. Understanding the fundamental dynamics of a newly emerging modern society would allow one to shape it and bring it closer to the ideal. In other words, gaining fundamental knowledge of living beings and humans meant that both fields had to formulate the reasons rationally and consistently for their actions during these centuries. Thus, the positivist view of modern science, which is based on fundamental discovery and perfect results in the natural sciences, remained valid and robust until the second half of the twentieth century.

In the nineteenth century, positivists and materialists attempted to discover universal laws. They thought that this would help them learn about nature and society. They used biology and sociology to this end. As a result, the attempts of biology to classify living things based on Darwin's theory of evolution and the attempts of Auguste Comte and other founders of sociology to find social laws ran in parallel and used similar methods. This is because both methods attempted to locate basic rules about how the objects they studied were formulated. Furthermore, everything they examined would inevitably be interpreted according to the prevailing positivist and materialist points of view.

On the other hand, however, the existing philosophies of science have had different effects on both fields. Moreover, the data in these fields have caused them to affect each other reciprocally and dialectically. As such, biology, which is based on Darwin's theory of evolution and attempts to identify the organization of living beings, and sociology, which attempts to identify the organization of people, both outlined theories in the same century by looking at their subjects in similar ways.

Organization theories have also contributed to identifying how the Industrial Revolution in the nineteenth century shaped modern society. For this reason, the first examples of organization theories mentioned closed, rational structures based on a specific input–output relationship with a fixed internal order. Between 1900 and 1930, organizational models were heavily influenced by scientific management theory (Frederick Taylor), administrative management theory (Henri Fayol) and the theory of rational bureaucracy (Max Weber). Within the framework of these theories, social organizations were seen as self-contained mechanical systems with a clear input–output relationship. Therefore, when looking at the structure of industrial society from this paradigm of knowledge, the organization method for small groups and large communities was shaped primarily by the concern for providing the most efficient network of outputs and relationships. This concern gave rise to the notion that organizations could best respond structurally to the existing struggle within a given competition. This resulted in the most

concentrated forms of organization, just as living things in nature behave most strongly and efficiently toward sustaining their generation.

Darwin's theory of evolution states that the greater the differences and uniqueness of species in an area, the better chance they must survive for a long time [1]. Diversification was interpreted here as a strategic move in the organization of life. As a result, species did not evolve independently and individually but rather as branches from a common point, with diversification causing differentiation.¹ Therefore, for [1], *natura non facit saltum* (nature does not make jumps) is a fundamental principle in the organization of living beings. From this point of view, the phrase 'survival of the fittest', which is considered the fundamental expression of the theory of evolution, was interpreted under the influence of industrial development and the progressive approach of the nineteenth century, not as the 'fittest', but as the 'strongest will win the competition'.

Comte saw work and the organization of scientific knowledge as structures that arose to achieve a kind of industrial wealth and measure of productivity. Moreover, he saw this organization as a source of human unity and progress [3, p. 95].² Diversification and differentiation were fundamental laws in natural organizations for maximum expansion and efficiency. Concerning social organizations, the best way to get the most out of industrial production while using the least energy would be to discover how society works at its most basic level. This would be the key to social prosperity. In fact, 'The growth of an 'organizational society' was synonymous with the inexorable advance of reason, liberation, and justice and the eventual eradication of ignorance, coercion and poverty' [6, p. 25]. This is because the modern industry was structured similarly to the struggle of living things in nature. Thus, competition and conflict between people and societies could be thought of as biological data and controlled by the knowledge of the natural sciences.

Sociology must use the natural sciences and biology as analogical elements. This usage was highly influential in explaining social structures. The power of this analogical effect is undeniable, especially in the foundations of sociology. Pareto, for example, attempted to explain how people in modern society seek equality using analogies from physics. This method significantly impacted other social scientists [7, p. 47]. For this reason, most sociologists of the classical period explained modern society under the influence of engineering and the technological structure of the Industrial Revolution while establishing analogous relationships with the functioning of living organisms. The most apparent influences and functional dimensions of biological analogies can be seen in Herbert Spencer's social-Darwinist approach and Emile Durkheim's organic-mechanical model of society. Both used the analogies of the nineteenth-century theory of evolution and knowledge of industrial organization to understand modern society's order and functionality as a new structure.³ With the theories from names such as Spencer, Darwin, Comte and Marx, the second half of the nineteenth century was interpreted as the golden age of the evolutionary paradigm [8]. The analogy between biology and sociology arose in this atmosphere, with the relationship between these two fields based on this analogical connection.⁴

For earlier organization theories, this relationship was also found between the theory of evolution and the theory of organization. Indeed, the fact that the rational organization model overlapped with the Darwinian and social-Darwinian models of evolution under the influence of the Industrial Revolution is no coincidence. The rational organization model was the first organization theory of the twentieth century [10]. It was a formal way to arrange an organization's

¹The theory of evolution was a well-known and widely discussed idea even before the nineteenth century. Charles Darwin was not the only person who worked on models of evolution, but he was the most successful. During the same period, Alfred Russel Wallace's research on the theory of evolution and his intimate conversations with Darwin contributed to Darwin's model of evolution [2].

²Adrian Bejan developed the approach of Comte by explaining the organization of structures with the concept of Constructal Law, starting from the existence of a natural and knowable scientific principle [4,5].

³Although Durkheim generally objects to biological inferences with a social positivist approach, his application of primordial causes in analysing the organizational form of social structure, mechanical-organic separation, and the concept of division of labour shows that he is influenced by biological analogy.

⁴This analogy continues to this day. For example, recent studies analogously treat the stages of cell development and social development and organization. An example can be found in [9].

structure to work logically towards a specific goal. The competitive dimensions of the division of labour and specialization in terms of social differentiation have been studied and defined concerning the structure and organization of modern society. The rational organization theory interpreted the Darwinian theory of evolution's concept of the strongest as the fittest and, by so doing, aimed for robust social order and stability. It targeted the most efficient and powerful, such as social structure and social organizations. Therefore, having modern industrial production be clear, organized and logical would also affect how modern organizations are established and almost automatically regulate society. This is like how competition is the main driving force behind the organization of life, giving it order and balance.

After the 1930s, rational organization theory began to give way to natural system theory. Including psychological and environmental factors that affect organizations is a big part of how biological system theory has grown, especially in studies that examine how well industrial organizations work. Emotions, senses and environmental factors are psychologically more effective than expected in social organizations. They have changed the one-way relationship between inputs and outputs in the rational organization model as well as how it works, with motives and values now having a more functional place in social organizations.

In terms of system representations, early writers on organizations were overwhelmingly 'closed' and 'rational' theorists, whether they were sociologists like Weber (1978), management consultants like Fayol (1949), or engineers like Taylor (1911). However, from the 1930s to the late 1950s, the focus of analysis shifted to seeing the organization as a natural organism that changes over time. [11, p. 53]

By adding new factors to the then-current rational organization theory of the 1930s, a transition occurred in which both paradigms of knowledge worked. For example, Elton Mayo Hawthorne followed the school of natural systems theory in his studies. Like Taylor, he put interpersonal relationships and psychological effects at the top of his list of priorities and emphasized efficiency and scientific management. Daniel Katz and Robert Kahn's [12] study was critical in psychology because they revealed how environmental and psychological factors affect organizations. On the other hand, some theorists, like Likert [13] and Homans [14], examined social organizations by considering important background factors such as class, race, psychological effects and cultural structures. However, others, like Barnard [15] and Selznick [16], attempted to reveal that social organizations were open to understanding closed, mechanical and rigid industrial production systems according to rational organization theory. 'Mayo's analysis of industrial problems, Homans' study of human groups, Barnard's study of organizations, and Parsons' study of social systems all reflected the assumption that their subject of study tends to achieve a state of equilibrium' [7, p. 62].

However, the relationship considered analogous in the nineteenth and twentieth centuries had gone beyond this point by the second half of the twentieth century, after the 1960s. This explains why the 1960s and subsequent periods are the subject of this study, examining the standard paradigms of knowledge among modern synthesis, neo-evolutionism and organization theories. The course of the relationship between evolution and society reveals that it is not just an analogy. In the first phase, however, this relationship has been realized by assuming a one-to-one correspondence and similarity between discovering the structure of biological organisms, uncovering their laws and learning how societies become organized.

The theory of evolution, one of the fundamental theories to have shaped the social and natural sciences in the nineteenth century, was the cause and effect of this change. Contrary to life being an absolute field of living and reproducing, and thus a constant area of conflict, the discovery of altruistic acts instead of selfishness, even in non-human beings, changed the evolutionary view. If even animals perform such altruistic and community-oriented acts, the relationships in the human social organization must have been even more complex than was thought. Thus, with modern evolutionary synthesis and the neo-evolutionary paradigm in the 1960s, modern organizations' conflicting and competitive order changed from closed to open,

from conflict to harmony, from egoism to altruism and from rigid boundaries to flexible variable structures.

3. The theories of modern evolutionary synthesis, neo-evolutionism and organization

One of the main goals of sociology is to understand the organization of human societies by finding out in which ways, how, and on what factors they are shaped. On the other hand, the main goal in biology is a fundamental debate about how human life, and hence its physiological and biological existence, is organized, by what factors it has been shaped, and in what direction it continues to be shaped. Considering all these developments, the theory of evolution transitioned from the orthodox Darwinian approach of the nineteenth century to the modern evolutionary synthesis (neo-Darwinism) after the 1960s. In this transition, both the new data obtained in the field of biology and the transformations brought about by the complexity of events in the social sphere considering life took effect simultaneously.

One factor that necessitates a modern synthesis involves the later approaches that attempt to interpret the Darwinian evolution model on an ideological and political level. Eugenics and biological determinist approaches condemned the hierarchies among races and the differences in development among societies to a physical and genetic destiny. Realizing this with scientific legitimacy also provided a universally and objectively evaluative mask for actions. However, using ideological approaches in favour of the overall perspectives of the time led to Social Darwinism becoming decisive in state policies.⁵ Although some ideas about the changes in the evolutionary processes of life in such an environment are possible, the question of genetics (i.e. how fixed traits were passed on) still needs to be clarified.⁶

The effects of biological determinism in social life have been realized through the scientific organization. However, while there have been some critical objections to these approaches, the legitimacy of the determinism of the natural sciences remains very much in play. After the 1950s, developments in the natural sciences, particularly in physics and biology, began to diminish the certainty of this legitimacy and the notion of having access to knowledge about everything. Differences among societies and in cultural studies came to the fore in the social sciences. In addition, countries of the world began to obtain more knowledge of each other globally, which had an enormous impact on these changes. The discovery of unknown and unknowable communities reshaped the relationship between 'self' and 'others' in different cultures. The vision of establishing an ideal society by exploring the elements of modern society has lost its meaning. It was understood that the same factors and events have different social consequences in different societies and that social organization and action differ. It has been seen that societies are unique and follow different historical paths. This new perspective transformed the analysis of individuals and society into a highly dynamic and inexplicable field in which many different variables play roles simultaneously.

The abstract and concrete results of the Darwinian evolution model under the influence of ideological, social and scientific paradigms were united through the data provided by the evolving scientific tools. These tools formed the model of modern evolutionary synthesis thinking. While developments in the field of genetics and discoveries in cell biology were biologically influential in the construction of neo-Darwinian thinking, the deterministic distinctions generated by such debates in the social field as eugenics, developed/undeveloped race(s), cranial measurement and sociobiology, as legitimized by the theory of evolution throughout the twentieth century, had also brought social dimensions under the spotlight in biology.

⁵For detailed evaluations, see Degler [17].

⁶Darwin [1,18–20] also made statements suggesting that his studies needed to clarify this.

Thus, Julian Huxley, Theodosius Dobzhansky and Ledyard Stebbins attempted to achieve a modern synthesis by combining the Darwinian theory of evolution with the progressing genetic field, population biology and cell biology [21, p. 295]. In the context of the modern synthesis, 'Mankind is the only species which is engaged in two evolutions at the same time: the biological and the cultural' [22, p. 423]. For Dobzhansky [23], this simultaneous evolution in life and culture overcame the dualism that classical biology had brought from the past and eliminated the existing reductionist dualities of the Darwinian model. As in the past, the modern evolutionary synthesis, which aims to view the organization of living things from a more multi-disciplinary approach that includes social effects by freeing itself from the deterministic approach of the past, influenced the sociology of the 1960s and beyond with this dominant understanding of knowledge.⁷ However, debates similar to those of the nineteenth century also occurred regarding these interactions, and the transition to non-determinism only partially occurred.⁸ Throughout the twentieth century, debates continued about the level at which the genetic and social factors involved in the organization of life are influential and which variables may be more critical.⁹ Thus, the phase of discovering the organic laws of closed systems in biology gave way to the various open systems models in the twentieth century and, resultantly, to a more multi-disciplinary method [36].

Leslie White [37,38], Steward [39] and Childe [40] updated the Darwinian approach and developed the neo-evolutionary approach to explaining human history and social developments. Since the 1960s, the neo-evolutionary approach has proven to be a powerful paradigm for describing, explaining and analysing social organizations. Meloni [27] indicated that in the second half of the twentieth century, biology had moved from the individualistic and utilitarian paradigm of the nineteenth century to an altruistic and social/cultural one.

Based on this influence, Gerhard Lenski developed an alternative theory to the evolutionist view of Talcott Parsons. In doing so, he started with the direct interaction that the neo-evolutionary approach had established between technological developments and social structure. According to Lenski [28], technological developments and the correspondingly developed historical classifications were and are effective in understanding and defining the social. For Lenski, social organization theory was interpreted for understanding the foundations of the social organization of society and classifying the functioning of that structure, as seen in the common goals of most social scientists such as Tönnies, Durkheim and Wallerstein.¹⁰

With the advent of neo-evolutionary thinking, more open approaches that evaluate many factors together, such as the natural systems model and general systems theory, have come to the forefront of organization theories. As a result, interdisciplinary approaches have become more critical in making sense of objects in the world of living beings and humans in which these factors are simultaneously influential. Ludwig von Bertalanffy's [41] general systems theory aimed to achieve general laws based on interdisciplinary communication. They were achievable with holism, in contrast to the reductionist and closed-boundary methodologies of the past.¹¹ According to Bertalanffy, because of the past, the sharp distinctions and miscommunication between scientific fields led to rediscovering the laws each time in different fields, which meant a considerable loss of work and time. This view explains that although general systems theory

⁷For detailed evaluations, see Machalek [24], Machalek & Martin [25], Marshall [26], Meloni [27] and Lenski [28].

⁸For an example of the discussions that Neo-Darwinism is still a tool of evolutionary humanism, see Quilley [29]. For an example of the approach that argues that biological data upholding past determinism will be the final solution to dilemmas in sociological theories, see Rosenberg [30]. For an example that supports the need to adapt updated principles of evolution to social structure, not just limited to biology, but integrated into social systems, see Aldrich & Ruef [31].

⁹For example, the idea that genes are selfish and use organisms as subsistence is almost a fundamental assumption by Williams [32] and Dawkins [33]. However, for names such as Wilson [34] and Sober [35], who are at a critical point in the philosophy of biology, more is needed to explain what happens in human evolution in terms of the selfishness of genes. According to them, the causes of genes playing a role in the selection are much more complex and operate with much more altruistic dynamics.

¹⁰For detailed reviews on this subject, see Lenski [28].

¹¹The work of Boulding [42] supports the general systems theory.

was established much earlier, it was only in the 1960s that it returned to the agenda and gained importance.¹²

With his rational bureaucracy approach, Max Weber's metaphor of the iron cage, one of the most fundamental theories of institutional organizations in sociology, also became one of the theories discussed in the revision process of the 1960s. The works from the Aston Group Studies [43–46] and Joan Woodward [47–49] are examples that rethought Weber's iron cage and bureaucratic organizational structure in the 1960s and subsequent periods.¹³ Although both studies have inherently different approaches, they tended to reanalyse Weber's definitions of primary specialization, standardization and centralization at the level of the dimensions of organizations and their relationship to technology. The prominence of neo-evolutionism and technology in these years was similarly operative in organizational models.

On the other hand, Buckley [50] proposed a cybernetic model of society instead of a model of society that follows an equilibrium (homeostatic) approach. 'Just as modern systems theory promises to rescue 'purpose' from metaphysical disrepute, so may it help to restore the reviving concept of sociocultural evolution to the centre of respectable scientific concern' (p. 62). These words from Buckley prove that the evolutionary and sociological relationship had begun to move beyond analogy in these years. For Sahlins [51], while corresponding biological and hereditary bases explain certain senses and feelings, the social organization's structure determines their definitions and meanings. 'Thus, while the human world depends on the senses and the whole panoply of organic characteristics supplied by biological evolution, its freedom from biology consists in just the capacity to give these their own sense' (p. 12).

In the neo-Marxist revisions of conflict theories after the 1960s, energy and its uses appear as an essential determinant of the neo-evolutionary effect in explaining social structure. The fact that the modern synthesis of the same period emphasized the relationship with the environment in the changing and organization of life was no coincidence. In other words, the effort to re-understand social structure and organization with new elements of competition led to the emergence of new theories in which the Weberian approaches, which are the leading destination of the theories of organization, were simultaneously considered in the revision of the Marxist approaches to conflict [52,53]. Similarly, Marvin Harris attempted to overcome biological determinism in this synthesizing course of the paradigm concerned with the environment and the social by considering cultural materialism using ecological models.¹⁴ On the other hand, Sanderson's [55] concept of synthetic materialism precisely synthesizes the discussions here. According to him, the synthesis of Marx's historical materialism, conflict theory and biological determinism derived from Darwin gave rise to a way of thinking that he calls synthetic materialism.¹⁵

In the transition from modern to post-modern organizations, a shift occurred from closed and internal to open and environmental, from rational and structure-based approaches to approaches based on motives, feelings, values and processes. These transitions and diversifications occurred in organizational theories, much like the syntheses experienced with new technological capabilities and biological data in the theory of evolution. The 1960s saw the emergence of theories that considered the structural analysis of social organizations with new data (e.g. Blau, Pfeffer, Salancik) and theories that considered the relationship between environment and organization in reciprocal interaction (e.g. DiMaggio, Powell, Hannan, and Freeman, Lauman, Knoke). The existence of institutions, the consideration given to their transformation over millennia of history from a new perspective, and the idea that evolution makes understanding its impact on humans and their community so critical became the dominant thoughts.¹⁶

¹²Bertalanffy [41] mentions general systems theory in the 1930s.

¹³For detailed evaluations in this context, see Clegg [11].

¹⁴For detailed evaluations of the ecological approach and the approach synthesizing cultural materialism, see Harris [54].

¹⁵However, Sanderson was also affected by the continuity of transformation and recognized that this conceptualization remained prosaic.

¹⁶For detailed evaluations of institutions' history and their continuing relationship with humanity, see Turner [56] and Turner & Machalek [57].

On the other hand, Lex Donaldson's structural contingency theory, Peter Blau's structural differentiation, and contingency theories were added to the structural-functionalist approaches after the 1970s. As mentioned earlier, the transition in organization theories led to the emergence of ecological-based (e.g. Hannah, Freeman, Baum), power-based (e.g. Perrow, Pfeffer, Clegg, Mintzberg) and institution-based (DiMaggio, Powell, Meyer, and Rowan, Berger and Luckmann) organization theories. Ecological, power and institutional theories differ in terms of prioritizing different factors. However, the common point where they meet is their inclusion of cultural, environmental, technological and cognitive factors when attempting to understand organizations, which, as William R. Scott noted, is due to the conditions of the time that were effective in the foundation of modern society culturally formed the normative structures and basic models of organizations. This formation operates so that socially and culturally accepted organizational structures such as firms, schools and agencies emerge under a particular type and management knowledge [58, p. 7].

To understand the organization of the biological, evolution has expanded to understand the social and other structures related to nature, along with the neo-evolutionary and modern evolutionary synthesis. After the 1960s, the fluid relationship of technological developments and even the second law of thermodynamics alongside the evolutionary and social developments began to come to the fore in this atmosphere. For example, according to Bejan [59]), a fixed physical structure in classical thermodynamics is considered one in which nothing increases or decreases. With the second law of thermodynamics (entropy), this approach has evolved into understanding a fluidly transforming and constantly moving structure. Every small or large structure in the universe continues to be designed by this flow principle [60]. Therefore, this principle of physical flow precisely unifies designs of the animate, inanimate, human and machine in nature, despite having different scales to the point of similarity in every respect [5,60–62]. In this case, both humans' social organization and the existence of the tools and technological structures humans have invented work as a manifestation of nature rather than an imitation of it [60]. Therefore, man is defined as *homo sapiens* and is divided into two. The biological and natural existence of humanity belongs to *homo*. By contrast, all remaining inventions belong to *sapiens* [59] because the structures that enable living things to move have also evolved to ensure the continuity of flow. In other words, the design change is the evolution in the social structure and biological field. Bejan put forward a perspective compatible with neo-evolutionist and modern evolutionary synthesis thinking, stating that the knowledge, tools and relationships people in a social flow produce are governed by a similar principle regarding nature.

Ultimately, Bejan developed a model of thought in which the products of nature and social structure act to maintain vitality and flow in line with the common principle of a standard system [60]. Behavioural commonalities in how living and non-living structures in nature are organized are also seen in how people build technologies and social systems because 'physics is such artefacts ('machines' in the most general sense), and physics also tends to acquire artefacts and build niches and social organizations' [62, p. 16]. 'Physics are all such artefacts (they are 'machines' in the most general sense), and physics is also the human tendency to acquire artefacts and to construct niche and social organization' (p. 16). Humans also act and diversify in any social organization model (whether a primitive community or a modern city) in the hierarchical, fluid and transforming tree model of the scientific principle of physics. This physical principle that builds the design takes place in an evolutionary process encompassing all living things, non-living things, humans and technology.¹⁷

This approach points to a paradigm similar to the explanations of neo-evolutionary thought that model the development of civilizations based on energy and how it is used. As Smil [64] indicated, his connections between using natural energies and social organization in the first representations of neo-evolutionary thought in the 1960s conveyed deterministic features. However, as biology and physics have come up with new information over the years, it has

¹⁷For a study in which the mentioned physics principle is evaluated in the context of the economy and social inequality, see Bejan & Errera [63].

become clear that more than energy alone will be needed to understand society's complexity.¹⁸ Along with these discussions, the paradigm put forward by the neo-evolutionary and modern evolutionary synthesis continues to be revised with new information provided by evolutionary and social data.¹⁹ Thus, new analysis methods need to be developed to explain the social structure of energy and the evolutionary approach without being deterministic in both senses (both biological and sociological).²⁰

The transformation of the definitions of classification given to objects of scientific knowledge, which has followed a similar course between the theories of evolution and organization while differing between periods, reveals the continuity of the relationship between biology and sociology. According to Luhmann [67], this is why the differences between the environment and the existing system produce a kind of social system and ensure the stability of the evolutionary process of organizations.²¹ Moreover, corresponding to Darwin's diversification and differentiation of species, the disappearance of relevant differences would also stop the process of social evolution. Luhmann's concept of coevolution was developed precisely to understand the operation of the differences between this environment and the system:

With the aid of the 'population' concept, older evolution theory localized the causes for variation within the system. On the one hand, this led to the view that demographic variables, mainly the irresistible human drive to multiply, are the factors that trigger all higher evolutionary development, for example, the transition to agriculture, the division of labor, and the formation of hierarchies. Nevertheless, on the other hand, such single-factor explanations are now considered obsolete. [67, p. 263]

In Luhmann's [67] opinion, the *autopoiesis* approach, which realizes the evolutionary process in its system by having a reflexive and variable structure that incorporates new information, fills this gap. On the other hand, Luhmann's theory of communicative action is also essential for defining the social system. Focusing on the relationship between the environment and the system, Luhmann is a vital example of one influenced by the neo-evolutionary paradigm, which assumes that the progressive, general and self-contained structure of the old understanding of evolution cannot understand the social.

As can be seen, modern synthesis means more than just the change in biology. Understanding the social dimensions that are effective in the organization of life requires rethinking the sociality of man as a biological being with new natural approaches. On the other hand, social and cultural determination has become an essential factor for biology to interpret its object.

4. Conclusion

The break in the scientific paradigm of knowledge since the 1960s has changed the perspective on life and human beings in all social and natural fields. On the one hand, this break involves the science of biology and the emerging modern approach of evolutionary synthesis, which has begun to change its previous thoughts and prevailing opinions thanks to the new data obtained for understanding the organization of life. On the other hand, neo-evolutionism and new models of social organization have occurred. Since the beginning of the modern age, the paradigm that has tried to understand the organizational forms of societies and social structures and discover their general regularities has changed, while new and more complex interactions

¹⁸See Smil [64] for a study that evaluates the relationship between energy type and uses with complex social organizations regarding related criticism.

¹⁹At this point, the dialectical and reflexive structure of the organic relationship in question gains a thinkable dimension with the complex system theory that covers the organizational forms of nature and the social holistically. See Thurner *et al.* [65] for detailed evaluations of the related theory.

²⁰For example, Ram Chandra Poudel and Jon G. McGowan argue that like many open systems in nature, the energy of human society can be analysed quantitatively by using the laws of thermodynamics. See Poudel & McGowan [66] for his work in this context.

²¹For detailed evaluations, see Luhmann [68].

have emerged. The fact that theoretical scientific formulae did not match what was happening in practice required a revision of the thoughts and theories based on new data. The semantic transformation of the term 'fittest' in the theory of evolution to 'best adaptable' rather than 'strongest' is one of the most fundamental indicators of the post-1960 break and revisions to the theory. This was because adaptability and adjustability have become essential criteria rather than strength-producing flexibility, which increases the speed of adaptation to change in organizations. Thus, the rational human and rational social ideal, which is only animalistic, mechanical, and has determinable order, gave way to complexity, probabilistic situations and indeterminacy in the scientific paradigm of the second half of the twentieth century. Thus, it has become clear that the organization of living beings is complex, as in the orthodox way of thinking at the beginning of the theory of evolution, and that the social is definable regarding a few factors. Thus, this study touches upon the new analogical paradigm between sociology and biology and reveals a dialectical and reflexive relationship with post-modern societal approaches.

Ultimately, the existing knowledge of biology in the foundation of sociology was influential in defining and explaining modern society and applying practices. Nevertheless, to call this relationship analogous is no longer sufficient because this structure, originally analogous, has begun to move beyond simple analogy in theory and practice by considering new information from biology and sociology. For example, biological structures influence society, and that social structures almost directly influence biological structures and have the power to transform them is now considered a well-known and accepted fact. Therefore, relationships that began with an analogical concern have evolved into genuine organic connections.

Consequently, focusing on biology when describing the social has become indispensable. The revelation of this organic relationship has also had transformative implications for the scientific definitions of both disciplines. The disciplines' methodologies, perspectives, theories and practical applications were shaped around this organic relationship in the 1960s and subsequent periods. The relationship among modern evolutionary synthesis, neo-evolutionism and social organizations, as explored in this study, demonstrates the present-day need for and importance of a sociological methodology that can be used in studies on society using new data from current biology and evolutionary thinking. Thus, the study provides a new theoretical perspective to the literature by showing that current biological data should be used with a comprehensive analysis of theories on sociology and organizations.

Meanwhile, supporting and testing the theoretical claim of the study with field studies will contribute to concretizing this relationship. In addition, the risk of throwing the analogical relationship between biology and sociology into deterministic explanations should always be considered in these possible theoretical and practical discussions. Finally, this theoretical study also reminds the literature about the risk of determinism.

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