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A Forgotten French Physicist: Georges Matisse (1874–1961)

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Abstract: The work of Georges Matisse (1874–1961), a French physicist, philosopher, epistemologist, and translator, has been largely overlooked, particularly his contributions to the history of science in the first half of the 20th century. His work focused on the emerging field of cybernetics and provided a philosophical perspective on new physics. His books delved into the philosophical underpinnings of scientific doctrines, viewing them as systems of reference and modes of representation rather than expressions of absolute truths. Although he could not personally attend the Copenhagen Congress for the Unity of Science in 1936, his talk was presented, offering a unique case study on uncertainty and determinism. Matisse employed an expanded notion of causality to study concrete facts in human societies, arguing against a universal law of history. His final book was dedicated to Bachelard. This paper offers initial insights into Matisse's sociology program, discusses his methodological approaches within logical empiricism, and outlines his perspective on the purpose of nature. The study concludes that Matisse's interdisciplinary approach, which included a theory on the relationship between religion and science, was based on his robust understanding of biophysics and scientific history.

Keywords: *cybernetics, emergence, science and religion, time-fluid*

Introduction

Georges Matisse (1874–1961) made significant contributions to science and philosophy during his lifetime, yet he remains relatively overlooked in contemporary discussions (see Fig. 1). Assessing his scientific eminence is challenging since he is not documented in histories, biographical dictionaries, or encyclopedias (Simonton, 1984, p. 170). In contrast, from 1921 to 1925, he authored a meticulously researched historical analysis of scientific advancements in France (Matisse, 1921–1925). This comprehensive work spanned four volumes, delving into natural, physiological, physicochemical, and mathematical sciences. It was highly esteemed by the intellectual circles in France at that time and acknowledged as a paragon of excellence by the French intellectual press of the era (Boll, 1925, pp. 723–726).

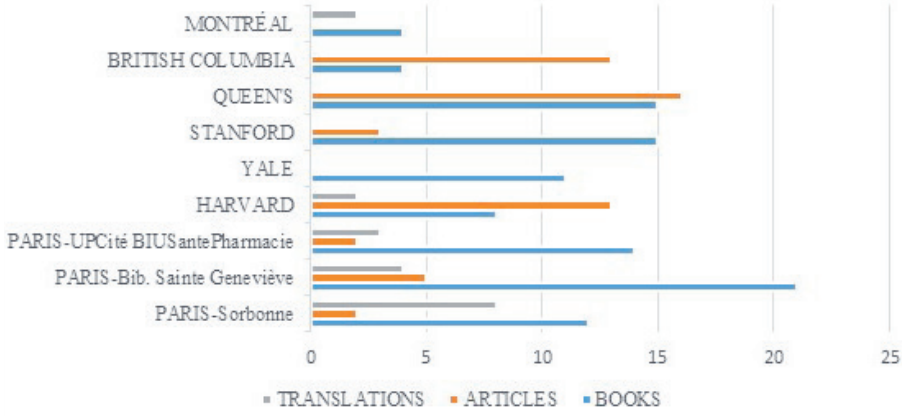

Figure 1. Matisse's major books are housed in academic libraries in Canada, the United States, and France.

In 1968, Teodor Ilyich Oizerman made the decision to include Matisse in the list of intellectuals who had grappled with the concept of wisdom as a genuine and important issue (Oizerman, 2019 [1968]). Matisse's connection to Europe's intellectuals and the Cold War, topics overshadowed by his status as a "forgotten" figure, prevented audiences from fully appreciating his work. For instance, in 1968, Ch. Momdshjan drew inspiration from Matisse's 1953 book *L'Incohérence Universelle. T.II: Les Logiques du Réel et les Lois de la Nature* to understand the logical-conceptual aspects of Marxism-Leninism. This was in preparation for Momdshjan's participation in the Vienna XIV International Congress of

Philosophy (Momdshjan, 1967). In grasping existential facts, Matisse employs a state theory, coinciding with Kurt Lewin's influential contribution to the philosophy of biology (cf. Lins, 1957, pp. 9–10; Wolters, 2018). While Kurt Lewin defines its field theory as addressing the limitations of the class theory, Matisse, as a solid constructivist, aligns closely with the correlation theory of truth by asking the question: "Can history really... be true?" (Braffort, 2004). It is important to note that a relevant criticism exists, particularly in the spread of the social constructivist truth in the socialist world during the latter half of the 20th century, causing a significant developmental shift in the relational theory of world politics. In this sense, Matisse was essentially associated with an avant-garde that claimed the worthiness of native values (Vulcevic, 2020).

According to the relational theory of truth, a statement is considered true to the extent it relates to other true statements. Unlike the correspondence theory, this approach prioritizes independent reality and assumes that trustworthy beliefs create an interlinked system where each element is connected to all others. Matisse's thinking is influenced by the correspondence between individual laws and statistical models (Matisse, 1936; 1955). His contribution to the French response to the "Austrian philosophy" framework involves challenging the assumption of the fallibilism of progress towards "objective knowledge" (Stadler, 2015). His somewhat difficult conclusion is that causality is a sequence imposed on timeless phenomena by the mind itself. He believes that the evolutionary narrative, which explains how organisms are interconnected in complex systems with which humans interact, expands on Darwin's theory of evolution. This new perspective replaces the idea of final causation with the theory of natural selection. Matisse advanced the idea of emergence as its first link (Hilton, 2017) and introduced the term "non-lavoisian chemistry" (Bachelard, 1940) to characterize the ahistorical nature of modern science. However, the two main propositions in Darwin's theory of evolution are of a historical nature. This makes the discussion of the principle of emergence in Georges Matisse's philosophy of nature an attractive research question, especially as approached at the Polish university in the 1970s (Zieba, 1975).

In October 1945, the communist magazine *La Pensée* criticized certain intellectual elites, particularly writers, for their collaboration with the Germans. One of the individuals discussed in the magazine was Georges Matisse, who had been an assistant to Georges Bohn in the Zoology Laboratory of the PCN (*certificat d'études physiques, chimiques et naturelles*) at the Faculty of Sciences in Paris for many years. The magazine also mentioned the metaphysical controversy between

Matisse and Ruyer, where Ruyer's neo-finalism was said to rival Whitehead's *Process and Reality*. This discussion arose in connection with a critical review of Matisse's book *Impassible Univers*, published by Éditions d'Art in 1944 (Bohn, 1945; cf. Dumoncel, 2001). Matisse had attended the Philosophy of Science Colloquium at the Grand Hôtel de la Mer in Morgat (Finistère) from September 10 to 17, 1938 (Eckes & Mazliak, 2022). His role as the event's protagonist is indeed complex, and that is because of how the published version of the *Entretiens de Morgat* saw the light of day during the *Occupation* (1942, 1944). The second fascicle subtitled *Causalité et finalité*, includes the discussion of Matisse's text on finalism appearing in the first fascicle, accompanied by a letter from Matisse to the French biologist Lucien Cuénot (Destouches, 1944; Chomard-Lexa, 2004; Eckes & Mazliak, 2022). Before and after this editorial incident, Matisse had openly endorsed democracy. On the one hand, Georges Matisse, along with his wife Madeleine, put their signatures on Roman Rolland's *Déclaration de l'Indépendence de l'Esprit*, which was published in Paris in the French Socialist newspaper *L'Humanité* on 26 June 1919, just two days before the signing of the Treaty of Versailles (Fisher, 1988). On the other hand, right after the *Libération*, Matisse published three volumes, *Le rameau vivant du monde* (1947–1949), in the *Philosophy of Science* section, directed by Bachelard, of the *Bibliothèque de Philosophie Contemporaine*.

This text serves five main purposes:

a) The first section provides the background for Georges Matisse's sociological and philosophical-biological research.
b) It discusses his role in the divide between analytical and continental philosophy, as seen in the Unity of Science movement congresses held in Paris in 1935 and Copenhagen in 1936.
c) The third section refers to cybernetics and the theory of systems.
d) The fourth section aims to define Matisse's unique method, based on the principle of emergence.
e) The fifth section addresses the foundation of our knowledge after Matisse.

What is the historical context of George Matisse?

Matisse conducted detailed research for each of his works to capture the backdrop accurately. Born in January 1874, and died in December 1961, Matisse studied mathematics, law, and biology at the University of Paris (Sorbonne) as *Docteur ès Sciences* (1919) (Anonymous, 1935; Braffort, 1999). To understand his life from a chronological perspective, we should look at his collaboration with Remy de Gourmont (1858–1915) in 1906. Matisse's ideas were well received by several French journals, mainly from Paris such as *Mercure de France* and *Revue des Idées*. In November 1916, he published Gourmont's obituary in *The Cambridge Magazine* (Matisse, 1915b). In the obituary, he acknowledged Gourmont's achievements and justified them in just a few sentences:

> no one possessed less than Remy de Gourmont the qualities of a manager [...] a typical representative of those artist-thinkers who lived in the days of the calumniated third Republic—hours of sunshine between two storms [...] we would say, misquoting a famous sentence: "He who has not lived in France a few years before the war has not experienced the happiness of free thought." (Matisse, 1915b)

His first contact with the radical press began with a study in French in *Le Genevois* on December 20, 1911. This also marked his relationship with Louis Rougier, a researcher of the scholastic mentality whose publication of his book *La structure des théories déductives: théorie nouvelle de la déduction* in 1921 was imminent. After the Second World War, Rougier dedicated his *Treatise of Knowledge* (1955) to him.

Between 1906 and 1914, he befriended scientists and philosophers such as Gustave Le Bon and Georges Palante. He worked with Le Bon to present new arguments for materialism under the name of energeticism. He likened the atom to the solar system in shape, charged with electricity, described in terms of vibrations in the ether, and viewed as the fundamental element of all matter according to science (Hatch, 2013). This is a reminder of the views of Lucien Poincaré, who believed that the mind can only comprehend relationships and that it is unreasonable to seek the cause beneath the law (Poincaré, 1906). He also opposed Jean Perrin's thesis, which was supported by experiments demonstrating the existence of atoms (Arabatzis, 2006, p. 96; Matisse, 1913). In 1908, Matisse published *Histoire extraordinaire des Électrons*, in which he describes physics as a source of fascinating stories. The electrons circulating the atom are depicted

as elves dressed in negative energy. They create a court for the monarch, which Matisse calls the atom, treating the positive charge as the robes that the king wears (Stasiowska, 2015). As well as Duchamp's cubist paintings, the concept of electrons entering human space brings to mind what Le Bon described in his 1905 book *L'Évolution de la matière* as "the dematerialization of matter" (Brauer, 2020 quoting Matisse, 1913). Just as Duchamp was intrigued by going beyond X-rays and N-rays, Matisse, who supported Marey's chronophotography, suggested that "matter dematerializes little by little; it becomes disembodied, as a spiritualist might say. An atom becomes an ion, an ion becomes an electron, then an X-ray, and finally electromagnetic energy." Kuhn (1962) would argue that because N-rays were not ultimately the fourth type of radiation alongside alpha, beta, and gamma rays, they were crucial in shaping the mentality of the scientific community.

With Palante, Matisse advanced the principles of sociology based on energeticism. He argued against the finalist theory of instinct and embraced a theory of chance and incoherence (Matisse, 1912). On the one hand, he opposed social disharmonies and antinomies to unitary and authoritarian sociology, and to finalism in rationalist moralism. However, in doing so, Matisse incorporated the laws of thought into universal energetics. This was in the context of an invitation from Jean Coutrot to participate in the "decades of Pontigny (1910–1939)," which aimed to redefine the social sciences under the influence of American professional practices before the Second World War (Bertelé, 1938; Clarke, 2001; Henry, 2004).

These initial thoughts may suggest Matisse's objective study of the external world without subjective influence. This approach was likely developed during his work at the Arcachon biological station in October 1909 (Matisse, 1910). His work caught the attention of the Spanish professor at the Carnegie Institute of Washington, José Fernández Nonídez, in 1919 (Arey & Crozier, 1919). During this period, those interested in understanding the influence of temperature on biological phenomena were directed to Matisse's remarkable work (Matisse, 1919). Georges Matisse defended this dissertation at the Sorbonne, along with Louis Bounoure, and both theses were accepted by Frédérick Houssay, the dean of the Faculty of Science, who awarded Georges Matisse the degree of doctor of science. The journal *Nature* pointed out that "the author has carried out a large amount of experimental work and correlated it with that of others" (Anonymous, 1920). The response of living organisms to stimuli can be quite complex and may not always follow simple laws. Matisse argued that biological processes, such as

cell division, heartbeats, and enzyme actions, are too intricate to be governed by straightforward rules. He specifically rejected the Van't Hoff coefficient as a constant, indicating that it could not be universally applied to physiological processes. He indicated that the authors "drown in an average general, the results of their experiments" (Matisse, 1921b).

In 1915, during the First World War, Matisse published *Aux Allemands: pourquoi n'êtes-vous pas aimés dans le monde* (To the Germans: Why does the world not like you?; Matisse, 1915a). Later, in 1921, he wrote *La transmutation de la sociologie* (The transmutation of sociology), portraying the enemy as a victim. This shift is reflected in the implicit conclusion of his work, suggesting that the science of probability should be seen as a collective set theory. This invites us to study the changes in human structure, as seen through the analysis of the rise of German superiority feelings by the Germanophile Matisse. According to Teilhard, the process of evolution, starting with biological evolution, continues through social evolution, but it does not conclude there. Matisse's concept of emergence resonates with this idea, as it involves a creative principle that leads to unpredictable, creative, and mysterious outcomes (cf. Wolters, 2018, p. 243). In line with Teilhard's viewpoint, Matisse's understanding of emergence suggests that evolution does not stop at the social level. Matisse's development of the concept of emergence during the Second World War is associated with the broadening of Darwinian evolutionary theory and its philosophical refinement, as exemplified in Conway Lloyd Morgan's *Emergent Evolution* (Morgan, 1923). Despite Matisse's critique of Bergson, this reasoning bears similarity to Bergson's, especially given his advocacy for the development of scientific philosophy, and his aversion to intuition-based methods (Picard & Tautain, 1914). Georges Matisse, as a philosopher of science, the physicists Branly and Perrin, and Henri Bergson, were all members of the Section of Psychical and Physiological Research, when it took this name (in 1909) at the General Psychological Institute in Paris (Krebs, 2015).

Matisse at the Unity of Science movement congresses (Paris 1935 and Copenhagen 1936)

As a French scholar, Matisse delivered a talk at the September 1935 International Congress for Scientific Philosophy, which took place in Paris at the Sorbonne (Matisse, 1936a; Buhl, 1936). This event marked a significant moment in the division between analytic and continental philosophy. Despite initial interest from Louis Rougier, the organizer of the 1935 Paris and 1936 Copenhagen congresses, Matisse did not become actively involved in the logical empiricism network later on (Dewulf & Simons, 2021). This suggested that Matisse preferred to develop his system of natural philosophy based on the intellectual atmosphere in Paris. It also highlighted the shared value held by both Louis Rougier (a logical empiricist) and Georges Matisse (a constructivist, emergentist) in not shying away from metaphysics, but instead aiming to conquer and dominate it.

As an advocate for the theory of emergence, Matisse represented an independent philosophical movement in France alongside others, such as Louis Glangeaud and Teilhard de Chardin. Despite theoretical differences, Matisse and Rougier shared the position that the solution to many philosophical problems lay in a critical study of the questions themselves. Recently, Professor Zygmunt Hajduk (from the Catholic University of Lublin) situated Matisse between Whitehead and Heisenberg, among those professional philosophers and scientists concerned with the philosophical implications of basic scientific theories (Hajduk, 2000). Despite this, Matisse faced the political dimension of logical empiricist philosophy. Rougier, as the organizer of the Congress, was closely aligned with the epistemology of the Vienna Circle and was ideologically connected to Matisse. They contributed in the same session, with both philosophers engaging with the liberal intellectual tradition in their work (Cantù, 2016). The third session of the *Congrès International de Philosophie Scientifique* in 1935 focused on the topic of pseudo-problems. Matisse, together with Rougier, Vouillemin, and Feigl, participated in the session. Rougier presented an analysis titled *Pseudo-problèmes résolus et soulevés par la logique d'Aristote* (Pseudo-problems resolved and raised by Aristotle's logic), where he emphasized that "language allows combinations of words that are grammatically correct but are illogical." Vouillemin, as a Thomist, introduced his work *Les énoncés non scientifiques sont-ils dénués de sens?* (Are the non-scientific statements meaningless?), which made the Carnapian metaphysical approach known beyond the German-speaking world. Feigl, in *Sense and Nonsense in Scientific Realism*, highlighted the division

between positivism and logical empiricism, leaning towards cautious empirical realism. Matisse's contribution, *Les pseudo-problèmes philosophiques* (Pseudo-philosophical problems), is the most significant as it includes a classification of five types of pseudo-problems followed by five sections offering explanations (Visser, 2016).

Cybernetics and theory of systems

In the work of Matisse, there is a clear connection between the theory of systems and the theory of society. According to C. G. Hempel (1936b), Matisse believes that life phenomena can be explained through a theory of systems with a structured organization, characterized by a regular order of material components and specific directionality of elementary processes. Matisse argued against the idea of accounting for life phenomena using disorderly collective wholes, emphasizing that the processes in living beings are organized, just like their structure. Matisse introduced mathematical methods in biology and sociology, which marked a significant shift in theoretical approach, leading to what Bachelard (1934, p. 135) refers to as a spiritual mutation. This transformation is crucial for understanding natural inequalities and positions Matisse as a biologist organizing such inequalities rationally (see Henry, 2004, p. 55). It signifies a profound change that demands considerable effort and is essential for unraveling the laws of nature, ultimately connecting the microphysical and macrophysical aspects of the universe with our biological interest and perception (see Čapek, 1953, p. 53). Therefore, Matisse's work serves as a testimony of what is happening on the macroscopic level of phenomena at the moment when biology is increasingly shifting towards microbiology (Lupasco, 1955).

Matisse was already thinking about negative feedback and was aware of the concepts and metaphors of cybernetics, which would later be called biological cybernetics. His mind was ready to reevaluate the results of the experiments and understand the difference between oriented phenomenon and final actions or behavior. This led to the creation of a three-volume series of books between 1938 and 1956 (see Fig. 2). The first trilogy, *La philosophie de la nature* (The philosophy of nature; 1938), contains 1. *Identité du monde et de la connaissance* (Identity of the world and knowledge), 2. *Le primat du phénomène dans la connaissance* (The primacy of the phenomenon in knowledge), 3. *L'arrangement de l'univers par l'esprit* (The arrangement of the Universe through the spirit). The second is *Le*

rameau vivant du monde (The living branch of the world; 1947–1949), divided into *Le déchiffrement des faits* (Decipherment of facts), *Philosophie biologique* (Biological philosophy), *Perspectives nouvelles du monde animé* (New perspectives of the animated world). Before concluding with his last work dedicated to Bachelard, *L'incohérence universelle* (The universal incoherence; 1953–1956) that includes 1. *Les logiques du réel et les lois de la nature* (The logic of reality and the laws of nature), 2. *Le principe d'émergence et le compartimentage du déterminisme* (The principle of emergence and the compartmentalization of determinism), and 3. *Le mirage de l'ordre* (The mirage of the order). In his final work dedicated to Bachelard, Matisse expresses the idea that the overall determinism of the Universe cannot be fully understood. He points out that our knowledge of the state, properties, and laws of a particular part of the Cosmos does not enable us to determine its state in another section of space-time, which may be separated from us by events or conditions of emergence.

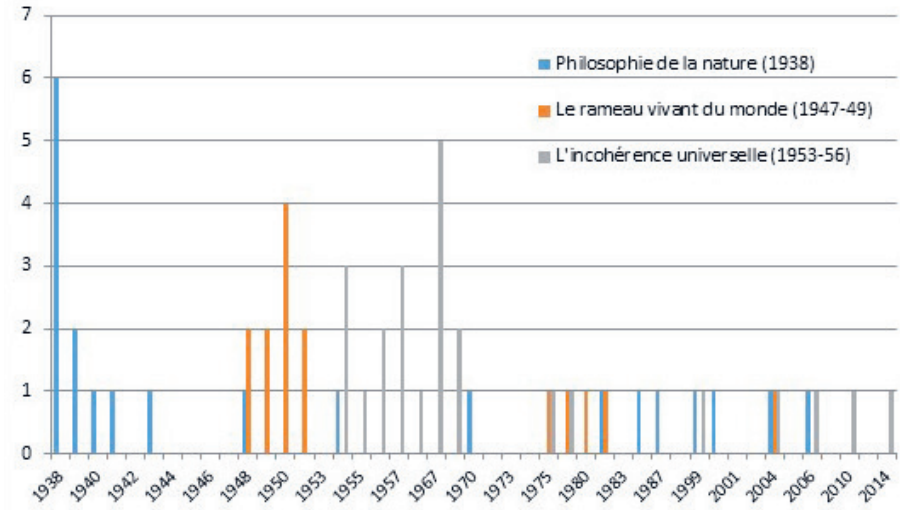

Figure 2. Matisse's three series of books in three volumes, published between 1938 and 1956, still receive citations.

This innovative initiative introduces systems theory, aimed at rejecting finalistic approaches in biology. It emphasizes that in inorganic systems, structures oriented are already present. According to Matisse, living systems should be viewed within a theory of structurally ordered systems displaying a regular arrangement of their material components, often combined with a specific direction of their elementary processes. The dissemination of the cybernetic approach began in

France, highlighting the influence of cybernetics on causality and unifying the study of control in each context under the system's identity. The distinction between environmentally activated thoughts and determined thoughts is crucial. There is no direct correlation between logical ideas present in thought processes and the terminology used to describe mental operations. It is never possible to categorically state that it is the mechanism of the mind (cf. Latil, 1956, p. 338). As Georges Matisse suggested, we often get lost in verbal symbolism, which is rich in fallacies that we fall for. We need to be vigilant against falling into the traps set by words, ready to expose their deceit and denounce their falsification (cf. Matisse, 1938c, p. 112). If our logical ideas are firmly based, they should not be tied to subjective terminology that is specific to an individual. Such words are always shrouded in a mysterious aura that cannot be analyzed. It would often be better to create new words that do not carry centuries of ambiguity and cannot be usefully used to precisely express ideas. When considering the construction of machines imitating the characteristics of living beings, Matisse does not see an identity between the machine and the living being. He argues that referring to "intelligent" machines or machines "capable of learning," original "intellectual production" of a "robot," constitutes an abuse of language.

The fundamental link between finality and biological cybernetics emerged after the Second World War. Its translation occurred during the sessions of the *Ier Congrès International de Cybernétique*, held in Namur in 1956, which included a fourth section on cybernetics and life, especially from the biological and medical perspectives (cf. Meynaud, 1960, p. 489).

Identity and definition of Matisse's methodology

Georges Matisse's methodology is based on the principle of emergence, forming the hierarchy of organized mechanisms (cf. Latil, 1956, p. 320). Emergentism is the analysis of the question about what is the origin of qualitatively new material objects. This doctrine vindicates the concept of emergence presented by Matisse for the following reasons: it develops its ontological facet, and not only the epistemological and methodological one; it applies to both abiotic and biotic processes; and the argument of its adequacy is extracted both from the natural sciences and from natural philosophy (Zieba, 1975).

In his attempt to understand thought mechanisms using cybernetic models, Matisse sees the methodological challenges of emergentism as similar to those of

a new molecule, a physiological trait, or an idea (cf. Morgan, 1923, p. 1). Matisse (1947, p. 135) also notes that the properties of a compound are rarely the sum of the properties of its components. Émile Durkheim had expressed a similar sentiment about social phenomena, contrasting Tarde's conception (Ouy, 1949). Often, a whole has very different properties from its constituent parts. This is evident through the failure of scientists who have tried to apply the deductive or logical rational method to the sciences of living nature (Matisse, 1943). Indeed, among the reviewers of *The Elementary Forms of Religious Life*, Matisse (in *Revue des idées*) objected to Durkheim's account of man as a homo duplex—"that old aberration which in deifying humanity, isolated it from the rest of creation" (cf. Lukes, 1973, p. 512). For Matisse, the hypothesis of emergence explains how novelty and creation can occur within the natural laws of physics. In 1943, this battle was fought on the pages of *France Libre*. Matila Ghyka (1943), in his attempt to capture the essence of the past in English scientific thought, quoted Georges Matisse from his 1938 book *L'arrangement de l'univers par l'esprit*. Matisse wrote that the law of energy conservation is nothing but "an unverifiable tautology." According to this view, the law is simply a static control, a barrier that will not be violated as long as we stay within certain preliminary definitions.

According to Matisse, the most significant achievement of emergentism was providing a suitable explanation for the transition from the non-living to the living world. Life emerges from a lower level, which is matter. Nevertheless, it is necessary to adopt a different mindset when seeking knowledge of the mineral world as opposed to the world of organized beings and biological phenomena. The difference between the logic of the mineral world and that of the living world, where the living being is considered an object, is a subjective concept. Even though Schopenhauer posits the will at the origin of the world, remaining the eternal generating power, an unconscious will in the mineral world that becomes increasingly conscious in the organized world and flourishes in thoughtful action in man (cf. Matisse, 1953, p. 34), Matisse (1956, p. 93) emphasizes that the facts of emergence seem to defy determinism and contradict. It is sufficient that within a chaotic set of molecules in disordered movement, a certain dissymmetry appears so that heterogeneous and oriented associations emerge. This constitutes one of the fundamental elements of vital phenomena, giving birth to the "Living Branch of the World." This core concept, as a conceptual pattern and idiosyncrasy in the structure of his texts, was already present in 1913. Matisse also highlights that the economists of the mathematical school, who created the "homo œconomicus," use the same method as in molecular kinetic theories. This method helps us to reach the simple global facts resulting from innumerable irregular phenomena and constitutes the theory of collective sets.

As Matisse said in 1938, "The so-called laws of chance relate to something other than chance; they are statistical laws that can be applied to collective aggregates with a determined and known constitution." This prompts reflections on finality as a methodological subject of the scientific debate on the subject of invention in biology. Based on the ideas of Lucien Cuénot, Matisse has a strong connection with Raymond Ruyer. This connection is influenced by the bourgeois anticlerical movement of the late 19th and early 20th centuries (Prenant, 1949). In Matisse's work *L'incohérence universelle*, found in volume III entitled *Le mirage de l'ordre*, Matisse contrasts the concept of order with that of the "chaos of the real world." Through a continuous debate in terms of biology between Matisse and Ruyer, their discussion rediscovers the consideration of the organism as a "generalized molecule," a concept valued by both Schrödinger and Matisse (Lessertisseur, 1959, p. 181). Additionally, the gene, viewed as a script code, is used to explain the emergence of structure through an increase in information.

On the foundation of our knowledge

Georges Matisse appreciates the tangible richness of the world and the contrast between the constraints of formal logic and the diversity of reality. He reveals the nature of the constructive elaboration of time through both objective (achronochore) and subjective (chronochore) expressions of physical quantities. However, he has been criticized for only offering the external frameworks of a bio-philosophy (Salman, 1949, p. 407).

The concept of time, as developed by Matisse, serves as a reference point used to categorize our perceptions. One of its characteristics, its one-dimensional dissymmetry and polarity, is connected to the irreversibility of physical phenomena (see Matisse, 1944, p. 134). However, some argue that the introduction of thermodynamic considerations into biological research lacks a comparative analysis of existing structures. Nonetheless, issues related to biochemical mutations would lead him to further explore the ontological meaning of the longing for coherence. According to Matisse, "Emergence brings about original properties, improvised phenomena, and unexpected laws in a system, which do not belong to the isolated or randomly distributed component elements" (cf. Matisse, 1956, p. 1). The desire to allow ourselves to be surprised by the objects generated by technology justifies the current increase in prominence of the theme of emergence (see Besnier, 2010, p. 33).

The history of biochemistry shows the limits of the mechanistic approach when applied as a philosophy of nature. Matisse argues that we need a new approach based on observation and aiming to reflect the actual mechanisms of facts. In the 1940s and 1950s, the gene and DNA were given significant importance in the cell. However, molecular biologists soon realized that gene expression involves complex control systems resulting in emergent properties of the whole. Matisse introduces the concept of finality as a hinge in the assimilation that cyberneticists connect between biological and feedback machine phenomena (cf. Matisse, 1955, p. 128). Cybernetics introduces the idea of a "control flow chart," which provides self-knowledge of limits as an observing direction of human thought. An approach to cybernetics from the presumptions of neurophysiology tends to understand enzyme induction as a matter of genetic control. However, Matisse considers events like the spontaneous formation of adaptable enzymes as exceptions to the law of causality (Matisse, 1949c). This original situation allows the construction of organized mechanisms based on the principle of emergence dear to Georges Matisse. To understand the significance, we should focus only on general principles rather than specific types. The whole presentation is based on the metaphysical presupposition that thought and the world are separate but that thought can still focus on the world (Kopper, 1955). To eliminate the uncertainty associated with emergence, events, we need to study why it escapes constructive intelligence and understand the conditions of the law.

Conclusions

Georges Matisse, a zoology professor at the Sorbonne University Faculty of Sciences from 1921 to 1938, advocated a form of evolutionary materialism. He engaged in a vigorous debate about the necessity of historical criticism. Despite living through what we perceive as dark, turbulent, and troubling times, Matisse did not comment on current political events. However, in March 1932, he joined an international petition against the Italian government's initiative, *Against the Fascist oath for Italian professors: An international protest by intellectuals*.

Matisse was trained in animal psychology, following the path laid out by the American biologist Jacques Loeb, particularly in the study of the mechanisms of animal sensations. Modern scientists acknowledged that the biological functions analyzed were dynamic laws of "orientation," showing a harmonious and two-way correspondence between organ and function. However, Matisse denied

the causal value of this relationship, arguing that it was not predetermined. Instead, he saw it as a physical vector of probability that occurred by chance. Furthermore, he believed that the organ was not designed for the function but rather, by the laws of casual evolution, the function invented and created the organ. Matisse's publications sparked strong protests with young scholars among the opponents, advocating for a principle of complementarity between the physicochemical aspect and the global biological aspect in biology. The relationships between biology and finalism can be summarized by comparing causality and finality. Science addresses questions starting with "How come… ? Why… ?" while teleology, which reasons by final causes, seeks to answer "In what purpose… ? What for… ?" At first, the two approaches may seem complementary, but the "scientific" approach often views the other as an attempt to discredit it. Matisse, a biologist, has much to say about transcendental finality. According to him, the "solution" to a philosophical question is not necessarily a "yes" or "no" answer or a doctrinal formula; instead, it often involves a critical study of the question itself.

Matisse moves beyond various dualities to uncover the mechanisms that foster emergence. He focuses on the nucleus-cytoplasm duality and explores the logic of mechanical and manual work, as well as the logic of becoming and creation, determinism, and uncertainty. By transcending these dualities, Matisse discovers unexpected properties and highlights the mechanisms of anomalies, such as Lapicque's epictesis, which involves an increase in inequality. The resulting organism emerges through various processes, governed by specific laws that are not accessible to knowledge. No natural law leads from the initial to the final states or vice versa, as the relevant information content of the initial conditions depends on the system's dynamics. This emergence undergoes irreversible evolution in its primary direction, requiring recognition of this irreversible creative gesture. The question arises whether we should intervene with knowledge or without it.

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