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Fossils, evolution, and progress: origins and development of a philosophical and scientific debate in England

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ABSTRACT - Since Darwin's time, biologists and philosophers have debated the issue of progress. Today, the concept of 'progress' continues to define evolutionary discussions, even though the origins of the concept date back many years before the publication of *Origin of Species* (1859). At that time, the study of fossils, together with all those natural transformations imagined to have occurred in the history of life on Earth, provided proper occasions to reflect on evolutionary changes, which were frequently interpreted in terms of progress. An optimistic view of natural history could be justified by such interpretations of the fossil record, which related the development of life to the continuous improvement of living forms. Going back to the philosophical and scientific origins of this debate, we can explore the motivations behind this view of evolution as progress through a historical and interdisciplinary framework. Due to the breadth of the subject, this article (with a few exceptions) will only consider the philosophical and scientific debate about these topics in the English intellectual context. I will begin by showing how the study of nature in the early 19th century was often linked to a progressive interpretation of animal classification and fossil discoveries. I will show later how evolution became associated with the idea of progress through embryology, influencing the English debates on species development. In the third part, I will move away from the purely scientific context for a moment to highlight how the issue of progress did not only concern the natural sciences or theories on the natural history of species but was also a prevalent theme in the English intellectual and historiographical culture of 18th century. I will conclude with a discussion of how "progress" was increasingly popular in Darwin's time (before he published *The Origin of Species*), also influencing creationist thinking and, naturally, Darwin himself.

Keywords: Evolution; progress; fossils; philosophy of nature; chain of being; Charles Darwin.

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1. A NEW VISION OF NATURE

In order to understand the history of evolutionary ideas (in reference to Darwin's time), we must first ask ourselves: what exactly were they talking about when they discussed evolution? Moreover, what kind of evolutionary theories could they relate to? We can better understand the origin of progress ideas in relation to evolution theory by answering these questions. First of all, we can see how often such themes were related to progress ideas. New species, their eventual evolution, and transformation, together with possible changes in the history of life, were all useful occasions to reflect on the possibility of such changes, as well as their dynamics, which were often interpreted through a progressive key, both in biology and geology. In order not to expand too much on the number of authors taken into analysis, I will focus mainly on the intellectual context and the scientific debate that was taking place on these topics in England.

As Martin Rudwick said, studies related to Earth's history along with naturalistic observations related to fossils suggested the idea that: "vertebrate life had become progressively more diverse during geohistory, by the successive addition of animals with arguably higher kinds of organization. It implied an overall directionality, or even progress in the history of the quadrupeds, which might also apply to the history of life as a whole" (Rudwick, 2008, p. 49). In the early 19th century, an important distinction had to be made in the history of geology between those who "postulated an earth in a steady-state or cyclic equilibrium and those who saw the earth's temporal development in directional terms" (Rudwick, 2005, p. 173). Some geological theories, for example, presented a uniform and cyclical view of Earth's history, without implying any development or progress; on the other hand, others spoke of a directionality of

Earth's changes (both in the atmosphere and geology), which gave the earth's history a more finalists and progressive feel. Similar arguments were made regarding species and their natural histories. There was sometimes a connection between the progressive geological history and the natural history of biological species. Therefore, to explain the evolution of organic creatures, it seemed logical to refer to the directionality or progress inherent in geological history itself. As a result, it also provided an idea for defending the theory of living things' possible development. (Browne, 1995-2002 [2018], pp. 182-184). After all, it seemed to be geological research itself that suggested this kind of interpretation of nature. As we read in the *Philosophy of Zoology* (1822) by the naturalist and geologist John Fleming (1785-1857): It is necessary to take notice of those facts illustrative of the origin of organized beings, which have been ascertained by the researches of modern geologists. In investigating the structure and composition of the rocks which constitute the crust of the earth, it is observed, that they enclose the remains of animals or vegetables, more or less altered in their texture. Presupposing that those rocks on which all the others rest are the most ancient; and after dividing them according to their age, as determined by their superposition, it has been ascertained, that the organic remains found in the older rocks differ from those which occur in the more recent strata, and that they are all different from the plants and animals which now exist on the surface of the globe. It likewise appears, that the petrifactions contained in the newer strata, bear a nearer resemblance to the existing races, than those which belong to the rocks of an older date. That the remains of those animals which have always been the companions of man, are only to be found in the most recent of the alluvial deposites. In the older rocks, the impressions of the less perfect plants, such as ferns and reeds, are more numerous [...] and the remains of shells and corals abound, while there are few examples of petrified fish. In the more recent strata, the remains of reptiles, bird and quadrupeds, occur, all of them differing from the existing kinds (Fleming, 1822, vol. I, pp. 26-27).

It seemed possible for these authors to draw an ascending line from the earliest and most primitive forms of life, as a result of the large number of fossil discoveries in the early 19th century; the context in which these theories moved was therefore progressive as fossil discoveries grew more and more extensive. Always following Fleming's work:

In the oldest alluvial deposits are found the bones of extinct quadrupeds; in the newer beds, those of such as still survive. From the period, therefore, at which petrifactions appear in the old- est rocks, to the newest formed strata, the remains of the more perfect animals increase in number and variety; and it is equally certain, that the newest formed petrifactions bear a nearer resemblance to the existing races, than those which occur in the ancient strata (Fleming, 1822, vol. II, p. 97).

By the early years of the 19th century, it had become clear that the study of geology also offered important insights into the natural history of species. Biology and geology were therefore in a very close relationship. This relationship had already been investigated in the 19th century, but it was only later that its great potential was recognized. Much of the information we have about the history of early evolutionary ideas comes from the geology volumes of this period. William Whewell (1794-1866), professor of mineralogy at Cambridge, remarked on this link between geologic and biological theories in his *History of Inductive Sciences* (1837, vol. III, p. 569). Whewell did not accept the evolution of species, and he criticized evolutionists because he thought they based their whole theory solely on progress, without considering any other evidence.

[T]hey have reasoned as if change, once shown to exist in the constitution of organic beings, could have neither limit nor selection; could not possibly be affected by [...] the conditions which this progression may bring into play. And in this way, all metamorphoses having become to them equally probable, they have given us a history of the gradations by which nature has ascended from the lowest step of organic life to the production of man [...] (Whewell, 1832, p. 103).

Some zoological classifications supported the idea that there was some kind of 'progressive scale' among living beings and their fossils ancestors, without necessarily implying evolutionary conclusions (Lovejoy, 1936; Bowler, 1976). Perhaps the concept of the *chain of being* did not univocally dominate the natural sciences of the early 19th century, but it undoubtedly represented one of its most important and widespread pillars, influencing the collective imagination through those schemes that placed man close to the ape, within that ascension of living beings that from the most primitive forms of life bring up to the Creator.

We can take a small example of these representations from the work of naturalist William Smellie (1740-1795), editor of the first *Encyclopaedia Britannica* and english translator of the volumes of Count de Buffon's *Histoire Naturelle*. According to him, our knowledge of the scale was very imperfect, but what was known: "gives us exalted ideas of that variety and progression which reign in the universe" (Smellie, 1790, p. 522). This progressive scale led to considering man "in his lowest condition, is evidently linked, both in the form of his body and the capacity of his mind, to the large and small orang outangs" (Smellie, 1790, p. 523). Therefore, it is very important to understand the ascending nature of many classification scales of that period, where living beings (along with fossils) were arranged hierarchically starting with those considered to be the lowest and moving up in order. This concept did not only concern zoology but also involved the (racial) classifications of the people of the time (Bowler, 1986).

There were also philosophers who criticized this idea. Voltaire (1694-1778), for example, believed that this famous scale was just a popular belief and criticized it in his *Philosophical Dictionary* (1764): The first time I read Plato and came across that gradation of beings which

ascends from the littlest atom to the supreme Being, that ladder struck me with wondre; but once i looked at it attentively, the great phantom vanished, as in the old days all the apparitions used to flee in the morning at the crowing of the cock. [...] This chain, this so-called gradation, no more exists among vegetables than it does among animals (Voltaire, 1764 [1962], p. 161).

Thus, some prefer to represent the natural world and its history with a map rather than a scale, without trend lines. However, some of these maps included progressive elements in their representations of the natural world, reflecting an idea of progress. The Tree of Life (another way to represent the natural world) soon became associated with the old idea of the chain of beings, influencing people's imaginations (Barsanti, 1992, p. 52 and p. 88). It was almost logical that the classification of fossils should be in a progressive order (sometimes) within such a context of ideas. The link between fossil and zoological classifications and the progressive image of the chain of living beings favored the spread of evolutionary ideas at the beginning of the 19th century, which were frequently linked to progress ideas (Bowler, 1975. *The Changing Meaning of "Evolution". Journal of the History of Ideas*, 36, 1, 95-114). Although some fundamental points were shared, there were many and often conflicting interpretations of these issues. It may be possible for paleontologists to use these ideas as a basis for talking about the progressive development of life, without implying an actual evolution of living organisms. Many scholars believed such a progressive development was the result of a series of special creations during the history of life and did not see any evidence of evolution (in the biological sense).

At that time, thinking about 'progress' and the 'progress of species' meant interpreting these concepts in very different ways: one could refer either to the direct action of natural laws or to the preordained providential plans of the Creator. In this context, progress was seen in many ways.

2. THE ISSUE OF EVOLUTION AND PROGRESS

Evolution and progress are connected in a more complex way. A major use of the term evolution occurred between the 18th and 19th centuries in the embryological debate. In the begging, the Latin term *evolution* was most commonly used by preformist embryology, which used it to refer to the development over time of preformed parts that had always existed in the growth of the embryo (known as homunculi). Therefore, the natural world is viewed in a static, fixist, and static way, denying any form of change within living creatures (for the history of this debate see, Richards, 1992). On the use of the term 'evolution' in the controversy between preformism and epigenesis, there is an interesting comment left by the German anatomist and physiologist Friedrich Tiedemann (1781-1861) who wrote in 1814: "The assumption of the supporters of the *evolutionary theory* that births originate from preformed germs is not at all acceptable, because the formation of the embryo, as we have seen before, does not occur by *evolution* but by epigenesis" (Tiedemann, 1814, p. 281). The term 'evolution' is used by Tiedemann in reference to the embryonic preform theory. However, the term had already been recognized in the English language even by those who did not subscribe to the preformist views and could therefore be applied to any discussion of embryonic development. As Stephen Jay Gould said, for the *Oxford English Dictionary* the word "evolution" in the 17th and 18th centuries: "It implied the appearance in orderly succession of a long train of events, and more important, it embodied a concept of progressive development - an orderly unfolding from simple to complex [...]". It's a "process of developing from a rudimentary to a mature or complete state. Thus, evolution was firmly tied to a concept of progress" (Gould, 1977, p. 35). It was precisely in this sense that it was used, for example, by Erasmus Darwin (1731-1802): From having observed the gradual evolution of the young animal or plant from its egg or feed; and afterwards its successive advances to its more perfect state, or maturity; philosophers of all ages seem to have imagined, that the great world itself had likewife its infancy and its gradual progress to maturity. [...] The external crust of the earth, as far as it has been exposed to our view in mines or mountains, countenances this opinion; since these have evidently for the most part had their origin from the shells of fishes, the decomposition of vegetables, and the recrements of other animal materials, and must therefore have been formed progressively from small beginnings. There are likewise some apparently useless or incomplete appendages to plants and animals, which seem to shew they have gradually undergone changes from their original state (Darwin E., 1791, p. 8).

In Erasmus Darwin's work (Charles Darwin's grandfather), we find the same elements we discussed regarding fossil research, zoological classifications, and progress. All these elements combined to create a new picture of natural history and nature itself. It was after the debate about the generation of living beings and in particular the debate about embryo development that some of the most controversial evolutionary ideas emerged during the eighteenth century. Some believed that the law governing embryonic development was the same law that governed the evolution or development of species throughout history. We have seen that the term 'evolution' precisely defined this embryological movement, which would later serve as a term to also define the progress and development of living things (Richards, 1992, pp. 15-16). The issue of embryonic growth, which was generally considered a process aimed toward the production of increasingly complex structures, led many authors (such as Erasmus Darwin) to draw an analogy between the phenomenon of embryological growth and the appearance or development of new species. As a result of this analogy, evolutionary theory began to be based on the assumption that organic complexity increased over time as indicated by the embryological

system and the fossil record, linking to the framework of biological classifications and finally to geological observations. The subject was considered to be of great importance for the natural philosophy of the time. The natural philosophy of the time considered this subject to be of great importance. In the early 19th century, perhaps the most interesting example is at Edinburgh University, where Charles Darwin attended in the mid-1820s. The University of Edinburgh's importance comes not just from Darwin's presence, but also from the liberal, progressive environment that characterized Edinburgh's scientific circles at that time. In Edinburgh, as much in the study of natural philosophy as in the study of the history of the Earth, one moved in a climate sufficiently free from the narrow grip of Anglican religious dogma (more common in Oxford or Cambridge) that allowed an open exchange of ideas and opinions on naturalistic, evolutionary and geological themes, promoting the study of natural history in numerous ways. An important example is an anonymous article printed for the *Edinburgh New Philosophical Journal* of 1826. It was edited by Robert Jameson (1774-1854), a naturalist and professor of natural history at the University of Edinburgh, whose lectures were also attended by Darwin himself. The importance of this article in the history of evolutionary ideas has already been emphasised by numerous scholars (Corsi, 2021, *Edinburgh Lamarckians? The Authorship of Three Anonymous Papers (1826-1829)*, in *Journal of the History of Biology*, 54 (3), pp. 345-374). The author of the article pointed out that: [T]he organic world, in each of its two principal divisions, exhibits a series of formations from simple to compound; the simplest being the oldest. Thus we observe animal life commencing in infusory animals, without any discernible organs. Simple digestive organs are first visible in the polypi; in the echinodermata the organ of respiration first appears; in insects a system of nerves and muscles; in crustaceous animals circula tion; and in the last two, simple organs of sense make their appearance. At the same time, generation preserves the peculiar character of organic beings; and after having accomplished its purpose, by mere division and dissolution, the particular generative organs develop themselves in distinct sexes. With the avertebral animals are conjoined the series of the vertebral, in which every system appears more perfect, and more closely connected. New organs of sense are unfolded, and the brain becomes the centre of feeling, perception and life, till in man its attains the highest state of perfection and endows him with consciousness and rationality (Anonymous, 1826, p. 296).

The language used in this article clearly refers to the idea of progress with which the classification of species and their natural history was read. Next, he wrote: Long ago, celebrated naturalists, relying upon these observations, attempted, with more or less success, to arrange the species of animals, sometimes according to a scale of gradation, and sometimes according to a reticulated form, without giving any distinct account of the meaning of such an arrangement. (*Ibidem*)

As we have already seen, sometimes species and fossils were classified differently. It is easy to imagine how these models inspired, in the minds of those who read them, a series of questions about the nature of such 'arrangements'. Obviously, it was not easy to find a definitive answer:

Should it, like the piling up of a collection of books, merely serve for a more convenient survey of innumerable creatures, without any reference to their origin? Or, do they intend, by means of such an arrangement, to express the design that hovered in the mind of Omnipotence, before he called these creatures into being? Or, have they originated in the way in which they appear in the scale of gradation, as if the hand of the Creator, like that of a human artist, perhaps, must first be exercised on simple formations, before it was capable of producing such as were compound? (*Ibidem*)

Answering these questions would have permitted the understanding of one of the last and deepest secrets of nature, removing the mystery that (at that time) still surrounded the classification and evolution of species. The important thing is that this led to a progressive system that was later named evolution. In this new scheme of the history of life on Earth, it was inevitable that its use (in some cases) would be associated with progress, thus fitting well with the idea of the gradual evolution of living beings. Early evolutionary theories were also accepted based on this link between progress and evolution. It is important to note that these ideas were often combined with the idea of the natural progress of living species (including humans), a concept that was widely accepted by philosophers and naturalists of the 18th and 19th centuries. In particular, as we will see, an attempt was made to unite the idea that the natural progress of the living species could also correspond to historical social progress. As a result, the progress of human nature was viewed within the context of nature's progress. In this case, scientific history was united with philosophical thought history.

3. NOT JUST SCIENCE: PHILOSOPHICAL CONSIDERATIONS ON PROGRESS BETWEEN THE 17TH AND 18TH CENTURIES

It is impossible to ascribe this idea of progress to a single interpretation; the incredible spread that characterized such a concept led it to become an idea known not only for the biological level but also for social development processes. By comparing the different stages of development of human society in its many historical phases, many authors believed they could demonstrate the existence of such progress (Nisbet, 1980). This could be accomplished through the analysis of the history and diversity of civilizations and populations around the world. In this way, progress (of man, culture, and society) began its development from the most primitive or ancient societies. These comparisons fuelled the belief that humanity has progressed in culture, where

modernity has finally triumphed over antiquity. This set of elements makes it obvious that it wasn't difficult to compare "present-day savages with living fossils", placing "evolutionary advancements from barbarian to European" along an evolutionary path (La Vergata, 1990, p. 89).

The optimism of the Enlightenment, along with other factors, allowed these visions to be found in many books and theories during the 18th and 19th centuries (Spadafora, 1990). Taking as an example a classic work of Enlightenment historiography, which is still known today, we can see how the ideas about progress were spreading during the late 18th century. Between 1776 and 1789, the historian Edward Gibbon (1737-1794) in his *Decline and Fall of the Roman Empire*, referring to the advance of the Roman conquests in England, wrote that in that case: "the spirit of *improvements* had passed the Alps, and been felt even in the woods of Britain" (Gibbon, 1776, vol. I, p. 49). The term 'improvement' was often used in conjunction with the term 'progress'. The concept of progress refers to a positive development leading to a positive outcome. In many cases, it was understood as a gradual progression from something simple to something complex, or from something inferior to something superior. A similar interpretation of progress could be applied both to the history of the earth or species, as well as to the development of society, and especially to the development of the human mind. Philosophical and scientific debates were influenced by all these ideas of progress at the end of the 18th century.

For example, Gibbon also speaks of the undoubted "progress of the human mind" during the empire of the Caesars (Gibbon, 1776 [1809], vol. VII, p. 387); he remarks that "the progress of civilization has undoubtedly contributed to assuage the fiercer passions of human nature" (Gibbon, 1776, vol. I, p. 232); and obviously "improvement" in many aspects of society, such as morality, agriculture, architecture etc. (Gibbon, 1776, vol. I, p. 52 and p. 225). We should not, however, assume that progress and the realization of it throughout history have always been simple concepts. Gibbon himself admitted that despite historical events appearing to support such progressive visions:

progress in the improvement and exercise of his mental and corporeal faculties has been irregualer and various; infinitely slow in the beginning, and increasing by degrees with redoubled velocity; ages of laborious ascent have been followed by a moment of rapid downfal; and the several climate of the globe have felt the vicissitudes of light and darkness. Yet the experience of four thousand years should enlarge our hopes and diminish our apprehensions: we cannot determine to what height the human species may aspire in their advances towards perfection; but it may safely be presumed that no people, unless the face of nature is changed, will relapse into their original barbarism (Gibbon, 1776 [1862], vol. iv, p. 409).

All this led Gibbon to conclude that: "We may therefore acquiesce in the pleasmg conclusion that every age of the world has increased and still increases the real wealth, the happiness, the knowledge and perhaps the virtue of the human race (*Ivi*, p. 410). According to Spadafora, the fact: "That such a man as Gibbon, caught up in the glories of antiquity and devoted to the study of historical decline, should take this position suggests how powerful the idea of progress had become by the 1780s" (Spadafora, 1990, p. 224). Several aspects of Gibbon's discourse are similar to those expressed in the naturalistic classifications we have discussed in the preceding pages in terms of how living things progress. Faith, and more generally ideas about progress, seemed able to overcome many doubts or difficulties in this case, even if they weren't indisputable dogmas. Several historians, as well as many naturalists and intellectuals, sometimes expressed skepticism about human progress or about the progress of living creatures in general. But, even at the time, such a progressive perspective remained strong in many minds, making it a vital part of historical considerations about society's development, as well as for naturalistic or evolutionary visions regarding life's history.

In the end, these authors always had the same objective; they attempted to observe mankind in its various stages, starting from creation or an early savage state, up to civilised man, trying to explain why our state was superior or at least better than that of other peoples, thereby establishing a comparison with them. Some authors also put the species in the context of historical development, because according to them there had been a progressive growth from lower to higher species within this historical development. The study of progress occupied such a vast field that some of these themes can be found in the writings of several authors of the time, from Adam Smith (1723-1790) to Erasmus Darwin. For example, as Evensky reminds us, for Smith the concept of "evolution", understood as development or growth, is of fundamental value in his analysis of human history, always taking into account the prospects for the future of society. "Based on this idea, Smith believed that the natural course of humanity had been a progression through four stages [...] and that this progress had been an evolutionary process." Smith himself, after all, used the term "progress" more than a hundred times in his *Wealth of Nations* (Evensky, 2015, pp. 11-12). In the intellectual context between the 18th and 19th centuries, many applied the concept of progress to the development of society and also to the development of human mental faculties (including morality). Nicolas de Condorcet (1743-1794) mentioned these ideas in his famous *Sketch for a Historical Picture of the Progress of the Human Mind* (1795); and William Godwin (1756-1836) in his *Enquiry Concerning Political Justice, and its influence on modern morals and happiness* (1793). In the same way, Adam Ferguson (1723-1816) said: If we admit that man is susceptible of improvement, and has in himself a principle of progression, and a desire of perfection, it appears improper to say that he has quitted the state of his nature, when he has begun to proceed [...]; like other animals, he only follows the disposition and employs the power that nature has given (Ferguson, 1767 [1966], pp. 8-9).

It seems, therefore, that nature itself allowed progress to exist. The theme of progress thus concerned the history of societies, the history of mankind and human culture, the history of our mental and moral faculties, the history of the earth, the history of life (reconstructed in a general way thanks to fossils), and theories on species evolution. As Sebastiani said "A major contribution of the Scottish Enlightenment is the idea of progress, seen as a natural and a historical process. Natural, as it is the result of the uniform and perfectible nature of humankind; historical, as it is a gradual process of change." (Sebastiani, *Beyond Ancient Virtues: Civil Society and Passion in the Scottish Enlightment,* in *History of Political Thought*, vol. 32, No. 5, Special Issue: *Passions and Virtues in Early Modern Europe*, 2011). In several cases, the history of the species was also part of this reasoning.

Erasmus Darwin is the perfect example of how philosophical theory and scientific research have come together on the subject of progress. He, in particular, combined with his evolutionary reflections those ideas of progress that we have just discussed, creating a marriage between socio-historical progress and natural biological progress. In the philosophical notes to his poem *The Temple of Nature* (1803), it is possible to note Erasmus Darwin's interest in the "progress of mankind in the arts and sciences", which in his view "continued slowly to extend and increase", focusing then on "the apparent progress of many animals towards greater perfection", an idea that seemed corroborated in his view "by modern discoveries and deductions as to the progressive formation of the solid parts of the globe, and consonant with the dignity of the Creator of all things" (Darwin E., 1803, p. 27 and pp. 65-69). It was precisely Erasmus who, through his writings, had tried to include the concept of progress in his biological considerations, almost in an attempt to "biologise" this idea (McNeil, 1987, p. 123). So, ultimately, progress during this period is a belief that mankind and the world are moving upward toward perfection. This philosophy of optimism was based on the achievements of man that came before, and on its projection for the future. As well as influencing the debate over human social and intellectual evolution, these ideas contributed to the debate regarding early evolutionary ideas of the natural history of humankind (Bossard, 1931, *The Concept of Progress*, in *Social Forces*, vol. 10, No. 1, p. 8). While philosophers tried to prove with their discourses the possibility that actual progress of mankind in its social, political, and intellectual conditions could be realized, naturalists and physicians of the early 19th century concretized these theories through their scientific works (e.g., Erasmus Darwin). To understand the origin of these ideas about progress in the evolutionary and naturalistic context, it is also important to note that some authors extended the concept of progress, already used to describe the evolution of social, political, and intellectual customs, to biological issues in the late 18th century. Between the 18th and 19th centuries, therefore, the connection between science and philosophy on the subject of progress finds its meaning in light of the historical and cultural dynamics of that period. Within these dynamics, there were reciprocal influences that shaped the debate on progress as we know it today.

Of course, we are interested here in the question of progress and its various declinations in philosophical, political, and naturalistic thought between the 18th and 19th centuries, but there were (as always) also many critics of this idea: the most famous example is surely that offered by Thomas Maltus's famous essay *On the Principle of Population* (1798). What must be remembered, beyond the various schools of thought that clashed on these issues, is that at that time the idea of progress had become very important in every area of knowledge, finding itself at the center of historical considerations on the past and future of both man and society and becoming a common thought even when some authors spoke of the development or evolution of organic species. Although there were many different interpretations of the concept of progress, these ideas also became very important in the context of Victorian science, increasingly influencing the debate on the history of species and their hypothetical evolution. As Spadafora noted many "educated men", and I would also add naturalists, "of this age looked back to the past or forward to the future, when they engaged in recollection or foresight or both, what they usually saw, in various shapes, was progress" (Spadafora, 1990, p. 18).

4. THE DIFFERENT IDEAS ON PROGRESS BEFORE THE PUBLICATION OF THE ORIGIN OF SPECIES

We have seen how concepts relating to the progress of living beings sometimes join those ideas based on faith in the perfectibility of man and his faculties. We have also considered how such models helped to spread and reinforce (in certain cases) the image of nature as progressive, both at the level of the natural dimension and at the level of social development. The keys to interpreting these models of progress in the history of society or in the history of nature could differ, and the authors were not always in perfect agreement when dealing with certain topics; however, a set of common ideas influenced their reasoning, establishing points of contact between the various theories of the time. In Victorian times some naturalists continued to believe that they could prove the concrete existence of a form of progress within the natural world using, for example, fossil research; while others, were unable to deny the gradual diversification of species along the different geological epochs, answered these questions by pointing out: That animals of different geological periods differ specially, en masse, from those of preceding or following formations, is a fact satis- factorily ascertained. Between two successive geological periods, then, changes have taken place among animals and plants. But none of those primordial forms of life which naturalists call species are known to have changed during any of these periods. It cannot be denied, that the species

of different successive periods are supposed by some naturalists to derive their distinguishing features from changes which have taken place in those of preceding ages; but this is a mere supposition, supported neither by physiological nor by geological evidence; and the assumption, that animals and plants change in a similar manner during one and the same period, is equally gratuitous (Agassiz, 1859, p. 76).

However, the concept of progress was generally shared, in different terms and with different meanings, even among those authors most attached to the creationist tradition. It was not unusual, in fact, to speak of a 'progress of creation', starting from the most remote epochs and continuing through geological time to the present day. In those years, for example, Roderick Murchison (1792-1871), one of the most important Scottish paleontologists and geologists of the time, in his famous *Siluria* (1854) explained how in the history of the world there had been a period when "no vertebrated animals lived" and how, in this case, "the appearance of the first recognizable fossil fish" represented "decisive a proof of a new and distinct creation" (Murchison, 1854, p. 461). Hence it was possible to apply to such acts of creation "the term of progressive or of that of successive", highlighting what appeared to be "the earliest great step in a progressive order of creation", right up to the "placing of man upon the terrestrial surface". Murchison showed how advancing through the strata of geological epochs, one could witness the profusion of larger and larger beings "all differing vastly from anything of their class" and with "skeletons of very singular forms"; the conclusion, therefore, was that these animals must have been successively "added to the other forms of [...] life" (Murchison, 1854, pp. 461-462). Murchison also reflected on the possibility that these data could be "clear signs of progress in creation" (*Ibidem*). In the mid-19th century, during the Victorian era, the concept of progress also influenced creationist thinking. This suggested the idea of progressive creation, from the simplest forms of life to the human being. As a result, many naturalists, geologists, and paleontologists continued to live in peace with their faith, accepting that the traditional idea of God's creation encompassed the new discoveries of natural history, geology, and fossil records. As the idea of progress grew, it was no longer just an exclusionary concept confined to certain philosophical theories; it wasn't just a vision of nature created by a few writers (such as Erasmus Darwin); but for many people a reality proven by natural history research. As Wilson said: In Britain, this view of the meaning of the fossil record was advocated by Hugh Miller in his *Foot-Prints of the Creator* (1847), by Roderick Murchison in *Siluria* (1854), and by Adam Sedgwick, who argued for it in a long preliminary dissertation to the fifth edition of his *Discourse on the Studies of the University of Cambridge* (1850). Progressive development was particulary attractive to Miller and Sedgwick because it not only preserved for them the concept of the world as having been created by God, but made man, who appeared last, the capstone of creation (Wilson, 1970, p. xxxiii).

Even if one could support ideas about the progressive creation of living beings, these creationist authors completely excluded "the hypothesis of a transmutation from lower to higher degrees of being", since the first decree of creation ensured "without doubt the perfect adaptation of animals to the surrounding media" (Murchison, 1854, p. 469). Nevertheless, many authors worked to develop a creationist view that justified the appearance of new species in the course of geological time, representing God as a divine planner and thus reconciling the existence of a first creator with the laws of nature as studied by science (Desmon and Moore, 1991, p. 242-243).

This idea of progress was therefore not completely rejected even by those naturalists or geologists who wished to illustrate the simple and only progression of living species along the course of natural history, without substantiating any evolutionary purpose. This obviously created a difference in the meaning of this idea of progress, but at the same time also served as an inspiration for all those evolutionists anxious to reconnect with these authors. For example, Robert Chambers (1802-1871), a theorist of evolutionary thought, explained in his 1844 book, *Vestiges of Natural History of Creation* (which was a huge success among the Victorian public), that his theory of evolution or development or transformation (there were many terms at the time) of species, linked to the idea of progress, had been suggested to him precisely by the books of those creationist men of science we mentioned above. In his book, *Vestiges*, Chambers explained that the table of the development of living beings that he inserted into the pages of the text had been suggested to him by the work *Rudiments of Physiology* (1835), published in Edinburgh by John Fletcher (1792-1836). Fletcher, like many other authors of the period, had presented a scale of living beings that "shews the wonderful [...] progress of creation, as presented to our observation in the succession of fossils and also in the fetal progress of one of the principal human organs", the brain. Chambers recalled how such representations, centered on a general idea of progress, were intended to express only "the appearance of advancement in the orders of the Cuvieran system" without "supporting a hypothesis" of transformation (Chambers, 1844, pp. 223-224). However, the author of *Vestiges* commented on how sharing this conception was "a wonderful evidence in favour of our hypothesis" (i.e. the evolutionary hypothesis) since "a scale formed so arbitrarily should coincide to such a nearness with our present knowledge of the succession of animal forms upon earth" (*Ivi*, pp. 224-225).

Although ideas of progress differed substantially from one another, some authors (such as Chambers) believed they could make connections between these various theoretical views of natural progress to support their own positions. This did not mean that the authors often used as examples to justify such progressive models were actually happy to see their conclusions placed within certain evolutionary contexts. Adam Sedgwick (1785-1873), for

example, (who had also been one of the early geological mentors of the young Charles Darwin) violently attacked Chambers's work for the way he had "distorted and misused all the careful and painstaking work of geologists and paleontologists in the preceding decades" (Rudwick, 2008, p. 549). However, even Sedgwick had offered a progressive view of the appearance of certain fossils (from the simplest and most primitive forms to the most articulate and complex), wondering if: Do, then, the ascertained phenomena of geology suggest a theory of development based on any known law of organic nature? So far as the theory is concerned the real questions for discussion are such as follow: Are the animal remains of our successive groups of strata presented to us in such an order as to suggest a theory of natural development by transmutation from one organic form to another? Are the Genera and Families of the old world so ill defined as to pass one into another by insensible gradations? [...] Do the organic types of the old world follow one another chronologically, in such a manner as to arrange themselves on any conceivable organic scale, whether simple or complicated? (Sedgwick, 1850, xlviii).

Of course, Sedgwick's answer in this regard was negative, yet for some authors these doubts remained partly unresolved, increasing the fascination for the development of possible alternative solutions to this issue (like the theory of evolution). Sedgwick criticized above all those materialists who were intent on offering affirmative answers for all the previous questions. According to him, these scholars essentially "discarding" the "pregnant facts of living nature" explaining only "the known by the unknown". They were merely reconstructing "hypothetically a chain of being" and putting it in "their system of nature". Thus, by "pretending to rescue" the natural world "from the province of miracle and fables" they were actually giving birth to a system that "at every step" was "both fabulous and miraculous, for neither is it historically true" nor "grounded on any ascertained natural law" (*Ivi*, xlix).

The idea of progress could, from this perspective, count on many supporters, both among creationists and evolutionists. The reason for this was that there were many ideas of progress based on different interpretations of nature. The result was that the debate on progress grew wider and wider. The philosopher Herbert Spencer (1820-1903) also spoke clearly about it, when in an article in 1857 illustrated "the law of organic progress", which he later linked to the law of all progress: Whether it be in the development of the Earth, in the development of Life upon its surface, in the development of Society, of Government, of Manufactures, of Commerce, of Language, Literature, Science, Art, this same evolution of the simple into the complex, through successive differentiations, holds throughout. From the earliest traceable cosmical changes down to the latest results of civilization, we shall find that the transformation of the homogeneous into the heterogeneous, is that in which progress essentially consists (Spencer, 1857 [1907], p. 8].

In his work, Spencer promoted the idea of evolution but linked it to the cultural tradition of progress. As a result (during the 19th century) biological evolution was often associated with the idea of natural and social progress (Burrow, 1968 and Hale, 2014). It should be clear how the discussion on the subject of progress (philosophical, social, and natural) was becoming increasingly broader, even involving cultural and literary circles. As evidence of the cultural ferment that characterized this debate, one could read a few pages written by Benjamin Disraeli (1804-1881) in his novel *Tancred*, published in 1847: [W] hat is most interesting, is the way in which man has been developed. You know, all is develoji- ment. The principle is perpetually going on. First, there was nothing, then there was something; then, I forget the next, I think there were shells, then fishes; then we came, let me see, did we come next? Never mind that; we came at last. And the next change there will be something very superior to us, something with wings. You understand, it is all science; it is not like those books in which one says one thing and another the contrary, and both may be wrong. Everything is proved: by geology, you know. You sec exactly how everything is made; how many worlds there have been; hovr long they lasted; what went before, what comes next. We are a link in the chain, as inferior animals were that preceded us: we in turn shall be inferior; all that will remain of us will be some relics in a new red sandstone. This is development (Disraeli, 1847, pp. 109-110).

5. THE OPINIONS OF CHARLES DARWIN ABOUT THE PROGRESS OF SPECIES

The figure of Charles Darwin (1809-1882) was thus placed within an intellectual context already largely conditioned by this set of ideas. His efforts to formulate a theory of evolution that took into account both the relative or contingent elements (like his theory of natural selection) and those closest to the climate of thought of his time (the many ideas of progress) led him to develop a quite peculiar conception of evolution. In it, he took on board his doubts about the concepts of progress and words like "superior and inferior" (understood as classificatory terms of the natural world); on the other hand, Darwin did not always succeed in following this line of reasoning, as he too was influenced by the same ideas of improvement and progress that characterised the naturalistic thinking of the Victorian world (La Vergata, 2010, p. 35). Charles Darwin attempted to reduce the importance of progress in species evolution with his work. For example, one of Darwin's most important contributions was to try to rethink our idea of progress when we observe the natural world: With respect to "highness" and "lowness" my ideas are only eclectic and not very clear. It appears to me that an unavoidable wish to compare all animals with men, as supreme, causes some confusion; and I think that nothing besides some such vague comparison is intended, or perhaps is even possible, when the question is whether two kingdoms such as the Articulata or Mollusca are

the highest. Within the same kingdom I am inclined to think that "highest" usually means that form which has undergone most "morphological differentiation" from the common embryo or archetype of the class (Darwin C., 1903, p. 76).

In a letter to Joseph Dalton Hooker (1817-1911) in 1858, referring to these topics, Darwin exclaimed: "how inextricable are the subjects which we are discussing!" (*Ivi*, p. 114). Like so many other times before, he was simply trying to make his thoughts clear: I do not think I said that I thought' the productions of Asia were higher than those of Australia. I intend carefully to avoid this expression, for I do not think that any one has a definite idea what is meant by higher, except in classes which can loosely be compared with man. On our theory of Natural Selection, if the organisms of any area belonging to the Eocene or Secondary periods were put into competition with those now existing in the same area (or probably in any part of the world) they (i.e. the old ones) would be beaten hollow and be exterminated; if the theory be true, this must be so. In the same manner, I believe, a greater number of the productions of Asia, the largest territory in the world, would beat those of Australia, than conversely. [...] But this sort of highness (I wish I could invent some expression, and must try to do so) is different from highness in the common acceptation of the word. [...] Not that I doubt a long course of "competitive highness" will ultimately make the organisation higher in every sense of the word; but it seems most difficult to test it. I should be sorry to give up the view that an old and very large continuous territory would generally produce organisms higher in the competitive sense than a smaller territory (*Ivi*, pp. 114-115).

But it was unclear why a particular specimen survived over others equally favored, and Darwin confessed: "The more I think, the more evident is it to me how utterly ignorant we are of the thousand contingencies on which range, frequency, and extinction of each species depend" (*Ivi*, p. 117). Appeals to contingency were characteristic of his theory, in which evolution's path was determined by a complicated interplay of natural and ecological dynamics. However, as he himself admitted, he 'regretted' abandoning the idea that evolution could produce organisms that were actually superior to their predecessors over time, and even though he tried to avoid creating comparisons that could be inadequate to describe his concept of evolution, he never denied that natural selection could work to improve and eventually perfect living things. As Gould said: " by adding a set of distinctive ecological arguments to the bare-bones mechanics - notably the domination of overt biotic competition as a primary mode of struggle within perpetually crowded communities - Darwin could validate the central belief of his surrounding culture, the concept of progress, as a primary signal of life's history" (Gould, 2002, p. 480).

As a result, his idea of evolutionary dynamics was always bound to include evolutionary progress, regardless of how relative it is. As Bowler wrote: Nevertheless he could not escape the feeling that an experienced naturalist could sense the relative complexities of the organisms with which he dealt, thereby providing at least an intuitive scale of organization. The question then became: if such a redefinition of the hiererchy were possible, would natural selection produce a general tendency for organisms to mount up the scale, i. e., a progression? (Bowler, 1976, p. 120).

Despite his attempts to relativize this concept, the cultural world around him remained so tied to the theme of progress that his works were often read through this lens. Consequently, Darwin was viewed as the person who confirmed that species and human progress follow a natural course. Darwin undoubtedly distanced himself from those who wanted to make man the preordained and inevitable (or even teleologically determined) end of an ascent of living creatures towards greater perfection; however, he never entirely excluded the subject of progress from his writings (Bowler, 1988, p. 6). However, this is not entirely a contradiction. Even while accepting a branched and differentiated evolution, it was not unusual to speak of species' progress. After all, such ramifications seemed to develop precisely from the bottom upwards, giving the impression evolution could be assimilated into a process of growth that eventually led to the progression of large numbers of organisms, developing their characteristics in an upward direction. Thus, the tree of evolution can be interpreted as a picture of the organic world's progress: "Although organization, on the whole, may have advanced and be still advancing throughout the world, yet the scale will always present many degrees of perfection; for the high advancement of certain whole classes, or of certain members of each class, does not at all necessarily lead to the extinction of those groups with which they do not enter into close competition" (Darwin C., 1859 [1909], p. 137). And then we read: The inhabitants of the world at each successive period in its history have beaten their predecessors in the race for life, and are, in so far, higher in the scale, and their structure has generally become more specialised; and this may account for the common belief lield by so many palaeontologists, that organisation on the whole has progressed. Extinct and ancient animals resemble to a certain extent the embryos of the more recent animals belonging to the same classes, and this wonderful fact receives a simple explanation according to our views (*Ivi*, p. 394).

Although clarifications were offered, the concept of natural struggle and selection seemed to imply that the exterminated specimens lacked structural or behavioral characteristics, being replaced by offspring that were defined as better or more developed than their progenitors. This was the general idea that, from time to time, seemed to emerge from Darwin's language when describing the losers in the struggle for life. Nevertheless, Darwin also wrote: But it may be objected that if all organic beings thus tend to rise in the scale, how is it that throughout the world a multitude of the lowest forms still exist; and how is it that in each great class some forms

are far more highly developed than others? Why have not the more highly developed forms everywhere supplanted and exterminated the lower? Lamarck, who believed in an innate and inevitable tendency towards perfection in all organic beings, seems to have felt this difficulty so strongly, that he was led to suppose that new and simple forms are continually being produced by spontaneous generation. Science has not as yet proved the truth of this belief, whatever the future may reveal. On our theory the continued existence of lowly organisms offers no difficulty; for natural selection, or the survival of the fittest, does not necessarily include *progressive development* - it only takes advantage of such variations as arise and are beneficial to each creature under its complex relations of life (*Ivi*, p. 136).

It is therefore difficult not to see in this storm of thoughts the sentiment of a man who, as Ruse wrote, was "struggling" with the idea of "progress"; indeed, he "believed in it, but was not quite sure what he believed in" (Ruse, 2009, p. 146).

There is no doubt that his contemporaries interpreted what was written in *The Origin of Species* in light of the ideas on the question of progress that was so prevalent at the time. Any reader of Darwin's books during that period would have been able to find all the references necessary to support an improved and progressive view of evolution. This is because Darwin, while criticizing the concept of progress, never completely renounced extending this view of nature to his evolutionary considerations. Given his time and place of living, this should not be a surprise. In this regard, the continual reference to a necessary cultural, intellectual, scientific, and naturalistic contextualization of Darwin's ideas is simply an attempt to restore his figure to the complexity of the scientific and philosophical debate that characterized evolutionary themes in the 19th century, by considering the works of the author of the *Origin of Species* (1859) in the light of the theoretical context of his time. If we decided to dispense with this context, we would lose the sense of those references in his writings to questions of progress, without understanding the complex history of these ideas.

6. CONCLUSION

During the 19th century, in the British context, the subject of progress continued to influence the debate on evolution, including theories about the development of society. Subsequently, the naturalistic and intellectual context of the time turned the subject of progress into the center of a whole series of reflections involving: the image of man's place in nature, the relationship between the so-called inferior and superior races, the schematization of the natural world, and even visions on the development of social and mental improvements. These concepts did not only belong to evolutionist theories but were also reflected in a large section of the intellectuals, writers, and thinkers of the period. Indeed, in the mid-nineteenth century, hardly anyone in British scientific and cultural circles could rule out the possibility that some kind of natural change had occurred in the history of living beings. The concept of a possible 'evolutionary succession' of organic creatures was therefore already widely circulated. However, it was often seen (by its opponents and supporters alike) as one of those notions inspired by a progressive view of the history of living beings. Even several creationist thinkers of the time, unable to deny certain incontrovertible data made known by palaeontological and naturalistic research, seemed intent on embracing creationist progress. Certain ideas have led us to see evolution as an upward movement or as a transition from the simple to the complex, or from the primitive to the evolved. In this way, the position in time occupied by living beings is often combined with a value judgment: the highest species are those at the top of the evolutionary tree, and the lowest species are those at the bottom (Gould, 2002). The idea that our evolution is a story of ascent from the bottom up also leads us to view man as the inevitable conclusion of this long progress, the ultimate goal towards which all natural forces in their evolutionary development have pointed. Similarly, popular images of evolution still tend to present the evolutionary process in a very distorted way. This includes placing, for example, *Homo Sapiens* at the top of the line, as if he were the 'highest' (in absolute terms) creature to appear on the planet. We are still attached to these interpretations of nature many years after progress ideas began to influence debates about the history of the earth, the history of species, fossil research, and evolution. Years ago, Carl Gustav Jung (1875-1961) was convinced that man had now "reached the limit" of his evolutionary journey, "the point beyond which progress is not possible" (Jung, 1999, p. 316). But in biology, this "capacity for progress" is that which allows progress to be made towards a development that "guarantees or facilitates further improvement" until an ultimate degree, a limit one might say, of development is reached. Such is the definition of evolutionary progress used by biologist Julien Huxley (1887-1975). From this point of view, wrote Huxley, "progress is unique since only one progressive line has continued" to advance up to "the present epoch: the line leading to man" (Huxley, 1963, p. 119 and p. 8). After this long debate, which still influences our considerations today, I personally believe, as Gould wrote, that: Darwin's revolution will be completed when we smash the pedestal of arrogance and own the plain implications of evolution for life's nonpredictable nondirectionality - and when we take Darwinian topology seriously, recognizing that *Homo Sapiens*, to recite the revised litany one more time is a tiny twig, born just yesterday on an enormously arborescent tree of life that would never produce the same set of branches if regrown from seed. We grasp at the straw of progress (a desiccated ideological twig) because we are still not ready for the Darwinian revolution. We crave progress as our best hope for retaining human arrogance in an evolutionary world (Gould, 1997, p. 29).

After the genetic revolution and the development of biology in the 20th century, after Darwin's thought has been enriched by new considerations about the development of life, Gould's words have even more depth and meaning. Today we are facing climate change challenges and the difficulties of rethinking our technological, industrial and economic progress. Perhaps the first step (as has already been done in part by Darwin) should be to rethink our evolutionary history without claiming to be the superior or most advanced outcome of evolution.

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