

CHARLES DARWIN AND ALFRED RUSSEL WALLACE
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ABSTRACT

The present essay is focused on the key role played by the Prussian explorer and polymath Alexander von Humboldt in the scientific vocation of Charles Darwin and Alfred Russel Wallace. From the very words of both British naturalists we learn that it was precisely the reading of Humboldt's *Personal Narrative* that ignited their burning desire to undertake the life of the naturalist. But, more relevantly, it was by following Humboldt's footsteps in the tropics, and, above all, by embracing his organismic concept of Nature, as a tightly interconnected Whole, that both Darwin and Wallace developed their scientific approach to nature, which, in turn, put them on the right track to discover *Natural selection* as the main mechanism responsible for evolution of living beings.

AESTHETICS OF KNOWLEDGE

What fascinates today's reader of the works of Alexander von Humboldt (1769-1859) is not so much their detailed analysis of scientific data or observations, these being currently outdated or of low heuristic value, but rather their aesthetic beauty - paradoxically one could say their literary 'non-topicality' - which still succeeds in involving the reader in the emotions felt by the author at the time of his travels and discoveries.

Not to mention that for over a century Western culture has been suffering from the divorce between scientific and humanistic knowledge, today scientific research is carried out by legions of scientists in a very different way than in the heroic times of Humboldt. The modern reductionist approach to nature - however essential for the progress of science - has led to an extreme fragmentation of scientific knowledge, which inevitably makes day by day more difficult the mutual understanding not only among scholars working in different scientific fields, but even among those dealing with different subjects belonging to the same discipline. This fact has also reduced the field of view of today's researchers, and consequently their ability to easily recognize the meaning and the role of every single natural phenomenon in the organization of the Whole.

Moreover, the specialization in science has gone hand in hand with the publication of extremely synthetic and hard-to-read papers, often supplemented by pages of jargon-filled notes on methodology, which, besides making scientific literature increasingly incomprehensible to layman, has ended up completely stifling the emotional and aesthetic components of knowledge, both essential for its appeal. This fact was perfectly recognized by Nobel laureate Francis Crick (1916-2004), when he wrote: «There is no form of prose more difficult to understand and more tedious to read than the average scientific paper».²

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² Crick, 1994, p. XIII.

The same cannot be said about the texts of Alexander von Humboldt. The writings of the great Prussian explorer - from *Personal Narrative*,³ describing his legendary exploratory journey in South America, Mexico and Cuba with his friend Aimé Bonpland (1773-1858), to his impressive treatise on natural sciences, *Cosmos*⁴ - are in fact a true ode to the aesthetics of knowledge. Humboldt was aware of this and indeed, in his works, he always sought to achieve both scientific accuracy and enthralling narrative. As he wrote to his friend Varnhagen von Ense (1785-1858):

I begin the printing of my work (the work of my life [*Cosmos*]). I have the extravagant idea of describing in one and the same work the whole material world [...] and to make this work instructive to the mind, and at the same time attractive, by its vivid language. [...] A book on nature should produce an impression like nature herself. [...] I have always endeavored to describe faithfully, to design correctly, and to be even scientifically true, without losing myself in the dry regions of knowledge.⁵

Thus, by adopting the legacy of German Romantic writers, Humboldt combined and masterfully harmonized scientific experiences and aesthetic feelings, since he esteemed both researcher's data and poet's similes equally important for the full comprehension of the laws of nature. This is the reason why Humboldt's 'out of fashion' texts are read today with great emotion and some regret.

Studying natural phenomena and the laws ruling them has undoubtedly positive effects on the socio-economic well-being of nations - Humboldt himself underlined its necessity⁶ - but the emotional and aesthetic aspects of scientific research must not be underestimated, because they exert an extraordinary positive impact on the imagination of man and on his choices. If, as we will see, Humboldt's *Personal Narrative of Travels to the Equinoctial Regions of the New Continent* was indeed, for both Charles Darwin (1809-1882) and Alfred Russel Wallace (1823-1913), the incendiary book that ignited their ardent desire to undertake the life of the naturalist, this was not so much because they were dazzled by the dense series of meteorological, magnetic, physical or geographical data that fill the long appendices and the footnotes of its chapters, but because they were 'magnetized' by the poetic similes which animate its pages and by the Romantic fervor with which the various natural phenomena are described. How could a young reader, eager to escape from a suffocating and monotonous environment, avoid being excited by passages such the following, and wishing to experience the same emotions as Humboldt?

³ *Personal Narrative of Travels to the Equinoctial Regions of the New Continent, during the years 1799-1804 by Alexander von Humboldt and Aimé Bonpland, written in French by Alexander von Humboldt; translated and edited by Helen Maria Williams, 7 vols. Longman, Hurst, Rees, Orme, and Brown, London (1814-1829).*

⁴ *Cosmos: a Sketch of a Physical Description of the Universe, by Alexander von Humboldt; translated from the German by E. C. Otté, 5 vols. Henry G. Bohn, London (1849-1858).*

⁵ Humboldt, 1860, pp. 35-40.

⁶ «An equal appreciation of all branches of the mathematical, physical, and natural sciences is a special requirement of the present age, in which the material wealth and the growing prosperity of nations are principally based upon a more enlightened employment of the products and forces of nature. The most superficial glance at the present condition of Europe shows that a diminution, or even a total annihilation of national prosperity, must be the award of those states who shrink with slothful indifference from the great struggle of rival nations in the career of the industrial arts». Humboldt, 1858, vol. 1, p. 53.

From the time we entered the torrid zone, we were never weary of admiring, at night, the beauty of the southern sky, which, as we advanced to the south, opened new constellations to our view. We feel an indescribable sensation when, on approaching the equator, and particularly on passing from one hemisphere to the other, we see those stars, which we have contemplated from our infancy, progressively sink, and finally disappear. Nothing awakens in the traveller a livelier remembrance of the immense distance by which he is separated from his country, than the aspect of an unknown firmament. The grouping of the stars of the first magnitude, some scattered nebulae, rivalling in splendour the milky way, and tracts of space remarkable for their extreme blackness, give a peculiar physiognomy to the southern sky. This sight fills with admiration even those who, uninstructed in the several branches of physical science, feel the same emotion of delight in the contemplation of the heavenly vault, as in the view of a beautiful landscape, or a majestic site. A traveller needs not to be a botanist, to recognize the torrid zone by the mere aspect of its vegetation. Without having acquired any notions of astronomy, without any acquaintance with the celestial charts of Flamsteed and De La Caille, he feels he is not in Europe, when he sees the immense constellation of the Ship, or the phosphorescent Clouds of Magellan, arise on the horizon. The heavens and the earth, - everything in the equinoctial regions, presents an exotic character.⁷

Now, let us consider in detail, through the very words of Darwin and Wallace, how fundamental was the role played by Humboldt's writings in their scientific vocation and desire to undertake overseas scientific journeys.

DARWIN AND WALLACE 'BEWITCHED' BY HUMBOLDT

After quitting his medical studies in Edinburgh, Charles Darwin, heartily encouraged to pursue a profession by his father, in 1828 enrolled at Cambridge University in order to become, if not a physician, at least an Anglican parson. As a student of Christ's College, he followed with great interest the lessons of botany held by Rev. John Steven Henslow (1796-1861), with whom, on most days, he took long walks «so that I was called by some of the dons “the man who walks with Henslow”».⁸

In his last year in Cambridge (1831), Darwin read Humboldt's *Personal Narrative*, which impressed him so much that during his botanical excursions with Henslow and his friends, he usually read aloud whole paragraphs copied from its pages. So writes Darwin in his autobiography: «During my last year at Cambridge I read with care and profound interest Humboldt's *Personal Narrative*. This work and Sir J. Herschel's *Introduction to the Study of Natural Philosophy* stirred up in me a burning zeal to add even the most humble contribution to the noble structure of Natural Science. No one or a dozen other books influenced me nearly so much as these two».⁹

In spring 1831, Darwin was so deeply immersed in Humboldt's evocative descriptions of Canary Islands and their vegetation, that he wrote to his cousin William D. Fox (1805-1880): «At present I talk, think, and dream of a scheme I have almost hatched of going to the Canary Islands. I have long had a wish of seeing tropical scenery and vegetation, and, according to Humboldt, Teneriffe is a very pretty specimen».¹⁰ With the same excitement he wrote to his sister Caroline:

⁷ Humboldt, 1814, vol. 1, p. 207. Translation by Helen M. Williams (1814).

⁸ Darwin, 1958, p. 64.

⁹ Darwin, 1958, pp. 67-68.

¹⁰ Darwin, 1959, vol. 1, p. 165.

All the while I am writing now my head is running about the Tropics: in the morning I go and gaze at Palm trees in the hot-house and come home and read Humboldt: my enthusiasm is so great that I cannot hardly sit still on my chair. [...] I never will be easy till I see the peak of Teneriffe and the great Dragon tree; sandy, dazzling, plains, and gloomy silent forest are alternately uppermost in my mind.¹¹

His plans to take a short trip to the Canary Islands were set aside when a letter from Henslow offered him an even more exciting opportunity to follow Humboldt's footsteps: a multi-year journey around the world on the brig-sloop *H.M.S. Beagle*, commanded by Captain Robert FitzRoy (1805-1865). Obtained his father's permission, on December 27, 1831 Charles Darwin left Plymouth aboard the *Beagle*, bringing some of his books with him, including Humboldt's *Personal Narrative*. Four days later he «spent a very pleasant afternoon lying on the sofa, either talking to the Captain or reading Humboldts glowing accounts of tropical scenery. Nothing could be better adapted for cheering the heart of a sea-sick man».¹²

Two months later, thrown the anchor off the coast of the New World, in Bahia, he recorded in his diary (February 28, 1832): «The mind is a chaos of delight, out of which a world of future & more quiet pleasure will arise. I am at present fit only to read Humboldt; he like another Sun illumines everything I behold».¹³ In May, still in Brazil, he wrote to Henslow that he was reading «Humboldts sublime descriptions. [...] I never experienced such intense delight. I formerly admired Humboldt, I now almost adore him; he alone gives any notion, of the feelings which are raised in the mind on first entering the Tropics».¹⁴ Even to his father he expressed words of praise for the Prussian explorer: «If you really want to have a notion of tropical countries, *study* Humboldt [...] My feelings amount to admiration the more I read him».¹⁵

Darwin's enthusiastic admiration for Humboldt and his travelogue was not a passing infatuation, a fleeting youthful straw fire that could easily get power from the exciting overseas experiences lived during his voyage aboard the *Beagle*. Rather, it was the exuberant beginning of a deep, grateful and more pondered sense of esteem that will animate the English naturalist all along his life. For instance, in 1845, nine years after he returned home, he wrote to the botanist and friend Joseph Dalton Hooker (1817-1911), who informed him about Humboldt's precarious health:

I grieve to hear Humboldt is failing; one cannot help feeling, though unrightly, that such an end is humiliating: even when I saw him he talked beyond all reason. If you see him again, pray give him my most respectful & kind compliments, & say that I never forget that my whole course of life is due to having read & reread as a youth his *Personal Narrative*».¹⁶

¹¹ C. Darwin to Caroline Darwin, April 28, 1831, in: Darwin Correspondence Project, Letter no. 98, <http://www.darwinproject.ac.uk/DCP-LETT-98>.

¹² Darwin, 1988, p. 18.

¹³ *Ivi*, p. 42.

¹⁴ C. Darwin to J. S. Henslow, May 18, 1832, in: Darwin Correspondence Project, Letter no. 171, <http://www.darwinproject.ac.uk/DCP-LETT-171>.

¹⁵ Darwin to his father, March 1, 1832, in: Darwin Correspondence Project, Letter no. 158, <http://www.darwinproject.ac.uk/DCP-LETT-158>.

¹⁶ C. Darwin to J. D. Hooker, February 10 1845, in: Darwin Correspondence Project, Letter no. 826, <http://www.darwinproject.ac.uk/DCP-LETT-826>.

Again in 1854, Darwin wrote to Hooker about the second edition of his friend's *Himalayan Journal*: «I shall be curious to hear what Humboldt will say; it will, I should think, delight him & meet with more praise from him, than any other book of Travels, for I cannot remember one, which has so many subjects in common with him. What a wonderful old fellow he is». ¹⁷

And the year before his death, at the top of his celebrity, Darwin still felt a desire to express words of great esteem for his 'myth of youth'. In fact, on August 6, 1881, replying to a letter from Hooker, ¹⁸ he wrote:

I believe that you are fully right in calling Humboldt the greatest scientific traveller who ever lived. [...] I should say he was wonderful, more for his near approach to omniscience than for originality. Whether or not his position as a scientific man is as eminent as we think, you might truly call him the parent of a grand progeny of scientific travellers, who taken together have done much for science. ¹⁹

It is also worth remembering that in 1842 Darwin had the unexpected opportunity to meet Humboldt personally at the house of the Scottish geologist Sir Roderick Murchison (1792-1871), but, as it often happens when one meets a person for years mythologized, the venerable man in flesh and blood somehow disappointed the young naturalist. In fact, so Darwin recalls that meeting in his autobiography:

I once met at breakfast at Sir R. Murchison's house, the illustrious Humboldt, who honoured me by expressing a wish to see me. I was a little disappointed with the great man, but my anticipations probably were too high. I can remember nothing distinctly about our interview, except that Humboldt was very cheerful and talked much. ²⁰

On the other side, it is interesting to read the impression that Darwin made on Humboldt in a letter sent by the latter to the English linguist Sarah Austin, in June 1844:

Alas! you have got some in England whom you do not read - young Darwin, who went with the expedition to the Straits of Magellan. He has succeeded far better than myself with the subject I took up. There are admirable descriptions of tropical nature in his *Journal*, which you do not read because the author is a zoologist, which you imagine to be synonymous with bore. Mr. Darwin has another merit, a very rare one in your country - he has praised me. ²¹

¹⁷ C. Darwin to J. D. Hooker, March 26 1854, in: Darwin Correspondence Project, Letter no. 1562, <http://www.darwinproject.ac.uk/DCP-LETT-1562>.

¹⁸ On August 4 1881, Hooker wrote to Darwin: «Now will you give me your idea as to whether I should be right in calling Humboldt the greatest of scientific travellers, or only the most accomplished, - or most prolific? It is the custom to disparage Humboldt now as a shallow man, but when I think of what he did through his own observations during travel, for Geographical distribution of plants, for Meteorology, for Magnetism, for Topography, for Physical Geography and Hydrography, for Ethnology, for political history of Spanish America and for Antiquity of Mexico - besides the truth and picturesqueness of his descriptions of scenery and all else - I am constrained to regard him as the first of scientific travellers; do you?». In Théodoridès, 1966, p. 53.

¹⁹ Darwin, 1959, vol. 2, p. 422.

²⁰ Darwin, 1958, p. 107.

²¹ In Théodoridès, 1966, p. 50.

Wallace also had expressions of great admiration for Humboldt. For instance, in his autobiography, where he remembers his days in Leicester (1844), when employed as teacher at the *Collegiate school*, Wallace writes, with words resembling Darwin's: «Among the works I read here [Leicester], which influenced my future, were Humboldt's *Personal Narrative of Travels in South America*, which was, I think, the first book that gave me a desire to visit the tropics».²² And reporting an excerpt from an old letter he sent to his friend Henry Walter Bates (1825-1892), he writes:

“I first read Darwin's *Journal* three or four years ago, and have lately re-read it. As the *Journal* of a scientific traveller, it is second only to Humboldt's *Personal Narrative* — as a work of general interest, perhaps superior to it.” [...] My reference to Darwin's *Journal* and to Humboldt's *Personal Narrative* indicate, I believe, the two works to whose inspiration I owe my determination to visit the tropics as a collector.²³

After perusing Darwin's and Humboldt's travelogues, Wallace read *Vestiges of the natural history of Creation* (1844): an anonymous book,²⁴ which, by proposing the daring idea of cosmic evolution and the transmutation of species, immediately became a best-seller, and like a bomb «thoroughly shook up the educated world of Britain».²⁵ Deeply impressed by this book, on December 28, 1845, Wallace wrote to Bates:

I have rather a more favourable opinion of the *Vestiges* than you appear to have. I do not consider it a hasty generalization, but rather as an ingenious hypothesis strongly supported by some striking facts and analogies, but which remains to be proved by more facts and the additional light which more research may throw upon the problem. It furnishes a subject for every observer of nature to attend to; every fact he observes will make either for or against it, and it thus serves both as an incitement to the collection of facts, and an object to which they can be applied when collected. [...] ²⁶

So, «rather dissatisfied with a mere local collection»²⁷ of beetles in the surroundings of Leicester, Wallace proposed to Bates an exploratory journey to some tropical region, to collect specimens of rare animals, with the aim to test the *Vestiges*' hypothesis (somehow borrowed from Lamarck) of the transmutation of species.

Encouraged by some visits to the British Museum, and the reading of *A Voyage up the Amazon* by W. H. Edwards, Wallace and Bates agreed that Amazon was the very place for them to go to. Thus, loaded their equipment on the small vessel *Mischief*, the two young naturalists sailed from Liverpool on April 20th 1848, and after a month of navigation they disembarked in the port of Pará (today Belém), at the mouth of the Amazon river.

Great emotion stirred Wallace when, three years later, still in South America, he arrived in «São Carlos, the principal Venezuelan village on the Rio Negro. This was the furthest point reached by Humboldt from an opposite direction, and I was therefore now entering upon ground

²² Wallace, 1905, vol. 1, p. 232.

²³ Wallace, 1905, vol. 1, p. 256.

²⁴ The 12th edition of *Vestiges* (1884) revealed that its author was the late Scottish journalist Robert Chambers (1802-1871). See Secord, 2000.

²⁵ Mayr, 1982, p. 382.

²⁶ Wallace, 1905, vol. 1, pp. 254-256.

²⁷ *Ivi*, p. 256.

gone over fifty years before by that illustrious traveller».²⁸ Who knows, probably by reaching that remote village in the Amazon forest, Wallace felt as if he were taking the baton from Humboldt's hands.

DARWIN AND WALLACE 'DISCIPLES' OF HUMBOLDT

The charming writings of Humboldt were not only crucial to fire the imagination and the vocation in both English naturalists, but they were also their literary and scientific models in approaching the study of nature and in writing their own travelogues; namely, Darwin's *Journal of researches into the geology and natural history of the various countries visited by H.M.S. Beagle* (1839),²⁹ and Wallace's *Narrative of Travels on the Amazon and Rio Negro* (1853) and *Malay Archipelago* (1869), respectively written on the return of his four years in South America (1848-1852), and eight years in South East Asia (1854-1862).

Without reporting, for the sake of brevity, significant passages of Darwin's writings, it is well known³⁰ that Humboldt's descriptions of nature were a model on which Darwin molded his own experiences and prose. Darwin was perfectly aware of this, since, in late September 1832, he entered in his *Beagle diary*: «the force of impression frequently depends on preconceived ideas, I may add that all mine were taken from the vivid descriptions in the *Personal Narrative* which far exceed in merit anything I have ever read on the subject».³¹ Even Caroline Darwin (1800-1888), after reading the first part of her brother's *diary* noticed how much, in its «flowery expressions», it resembled Humboldt's *Personal Narrative*:

I am very doubtful whether it is not *pert* in me to criticize, using merely my own judgment, for no one else of the family have yet read this last part - but I *will* say just what I think - I mean as to your style. I thought in the first part (of this last journal) that you had, probably from reading so much of Humboldt, got his phraseology & occasionally made use of the kind of flowery french expressions which he uses, instead of your own simple straight forward & far more agreeable style.³²

Wallace also molded the vivid pictures and thoughtful considerations of his travelogues on Humboldt's *Personal Narrative*. For example his melancholic thoughts raised by the mysterious beauty of the birds of paradise resemble Humboldt's contemplative observations while sailing along the mysterious banks of Casiquiare, the natural channel connecting Rio Negro and Orinoco rivers. So writes Wallace in 1869:

²⁸ Wallace, 1853, pp. 233-234.

²⁹ In 1839, with humility and perhaps some trepidation, Darwin sent a copy of his newly published *Journal of researches* to Humboldt himself, who acknowledged and highly praised the gift («Votre excellent et admirable ouvrage»). An euphoric Darwin replied with the following enthusiastic words: «That the author of those passages in the *Personal Narrative*, which I have read over and over again, & have copied out, that they might ever be present in my mind, should have so honoured me, is a gratification of a kind, which can but seldom happen to anyone». C. Darwin to A. von Humboldt, November 1, 1839, in: Darwin Correspondence Project, Letter no. 545, <http://www.darwinproject.ac.uk/DCP-LETT-545>.

³⁰ See Wulf, 2015, pp. 256-277.

³¹ Darwin, 1988, p. 443.

³² Caroline Darwin to C. Darwin, October 23, 1833, in: Darwin Correspondence Project, Letter no. 224, <http://www.darwinproject.ac.uk/DCP-LETT-224>.

I had obtained a specimen of the King Bird of Paradise (*Paradisea regia*) [...]. The emotions excited in the minds of a naturalist who has long desired to see the actual thing which he has hitherto known only by description, drawing, or badly-preserved external covering, especially when that thing is of surpassing rarity and beauty, require the poetic faculty fully to express them. [...] I thought of the long ages of the past, during which the successive generations of this little creature had run their course — year by year being born, and living and dying amid these dark and gloomy woods, with no intelligent eye to gaze upon their loveliness; to all appearance such a wanton waste of beauty. Such ideas excite a feeling of melancholy. It seems sad that on the one hand such exquisite creatures should live out their lives and exhibit their charms only in these wild inhospitable regions, doomed for ages yet to come to hopeless barbarism; while on the other hand, should civilized man ever reach these distant lands, and bring moral, intellectual, and physical light into the recesses of these virgin forests, we may be sure that he will so disturb the nicely-balanced relations of organic and inorganic nature as to cause the disappearance, and finally the extinction, of these very beings whose wonderful structure and beauty he alone is fitted to appreciate and enjoy. This consideration must surely tell us that all living things were not made for man. Many of them have no relation to him. The cycle of their existence has gone on independently of his, and is disturbed or broken by every advance in man's intellectual development; and their happiness and enjoyments, their loves and hates, their struggles for existence, their vigorous life and early death, would seem to be immediately related to their own well-being and perpetuation alone [...].³³

And here is Humboldt:

The uninhabited banks of the Cassiquiare, covered with forests, without memorials of times past, then occupied my imagination, as do now the banks of the Euphrates, or the Oxus, celebrated in the annals of civilized nations. In that interior part of the New Continent one may almost accustom oneself to regard men as not being essential to the order of nature. The earth is loaded with plants, and nothing impedes their free development. An immense layer of mould manifests the uninterrupted action of organic powers. Crocodiles and boas are masters of the river; the jaguar, the peccary, the *dante*, and the monkeys traverse the forest without fear and without danger; there they dwell as in an ancient inheritance. This aspect of animated nature, in which man is nothing, has something in it strange and sad. To this we reconcile ourselves with difficulty on the ocean, and amid the sands of Africa; though in scenes where nothing recalls to mind our fields, our woods, and our streams, we are less astonished at the vast solitude through which we pass. Here, in a fertile country, adorned with eternal verdure, we seek in vain the traces of the power of man; we seem to be transported into a world different from that which gave us birth. These impressions are the more powerful in proportion as they are of long duration.³⁴

More importantly than from the literary point of view, Humboldt influenced both naturalists with his *organismic* approach to natural phenomena and his Romantic - namely aesthetic and moral - conception of nature.³⁵ In fact, for the Prussian explorer the world was a sublime living Whole in which phenomena and forces were tightly connected and received their reason for being from their strong mutual relationships. Humboldt invented a new style of exploration, whose scientific phase was not limited to the collection, classification and description of nature, but also extended to the comparison and organic integration of observations and physical data in order to achieve the understanding of the mutual interactions of all natural forces and, in particular, of the peculiar relationships among organisms and their respective environments. This novel *holistic* approach was already present in his first scientific work on the hypogean flora of the mines of

³³ Wallace, 1869, pp. 448-449.

³⁴ Humboldt, 1819, vol. 2, pp. 437-438. Translation by Helen M. Williams (1819).

³⁵ Richards, 2002, pp. 514-554.

Freiberg (Saxony), studied by Humboldt when he was a student of the illustrious geologist Abraham G. Werner (1759-1817) at the School of Mines of Freiberg: (*Florae Fribergensis specimen plantas cryptogamicas praesertim subterraneas exhibens*, 1793).

Among several examples of this novel attitude to natural phenomena, centered on their close relationships, we can mention his explanation of the decrease of the waters of the lake of Valencia, in Nueva Granada (today's Venezuela). By studying the meteorology and the geology of that region, the crops around the lake and the human settlements, Humboldt suggested that the progressive, rapid drop in water levels of Lake Valencia could be due to the destruction of the nearby forests, the clearing of the plains, and the cultivation of indigo: three important environmental changes which, on one hand, had reduced the amount of water flowing in and, on the other, had increased both the evaporation of the soil and the dryness of the atmosphere.³⁶

Furthermore, when crossing the Andes and climbing some of its highest volcanoes, Humboldt carried out observations and accurate measurements which, by relating to each other meteorological, geological, geographical and botanical data, allowed him to describe the complex correlations among climatic zones and specific plant species. The results of this broad pioneering study, which laid the foundations of phytogeography, were collected in his *Essai sur la géographie des plantes, accompagné by a tableau physique des régions équinoxiales* (1805). In this work, in a strictly analytical way, latitude, altitude, composition of the air, precipitation, soil type, etc. are correlated with different types of flora: palms on the coast, broadleaf trees on the hills, conifers in the high mountains, herbaceous plants close to perennial snows, and so on. In this way, Humboldt demonstrated for the first time that a plant, such as a conifer, growing on the shores of the sea at the arctic latitudes could also be found at the equator, but only in places sharing most of the arctic environmental conditions, namely at the high altitudes of the mountains.

To visually describe these relationships Humboldt sketched mountain cross sections (fig. 1) and world maps where the areas with the same average temperature are connected with curved lines (*isotherms*, fig. 2). These graphic representations, invented by Humboldt, were the effective means to visually underline the close relationships between climatic and biological phenomena, and consequently the sublime and majestic unity of nature.

Thus, according to Humboldt, all natural objects and nature's forces are connected in a dense network of relationships, namely in «a Cosmos, or harmoniously ordered whole, which, dimly shadowed forth to the human mind in the primitive ages of the world, is now fully revealed to the maturer intellect of mankind as the result of long and laborious observations».³⁷ No metaphysics, no divine revelation can compete with science, if the goals are to define nature's laws and to possess a fact-based knowledge of the world.

³⁶ Humboldt 1819, vol. 2, pp. 71-75.

³⁷ Humboldt, 1858, vol. 1, p. 24.

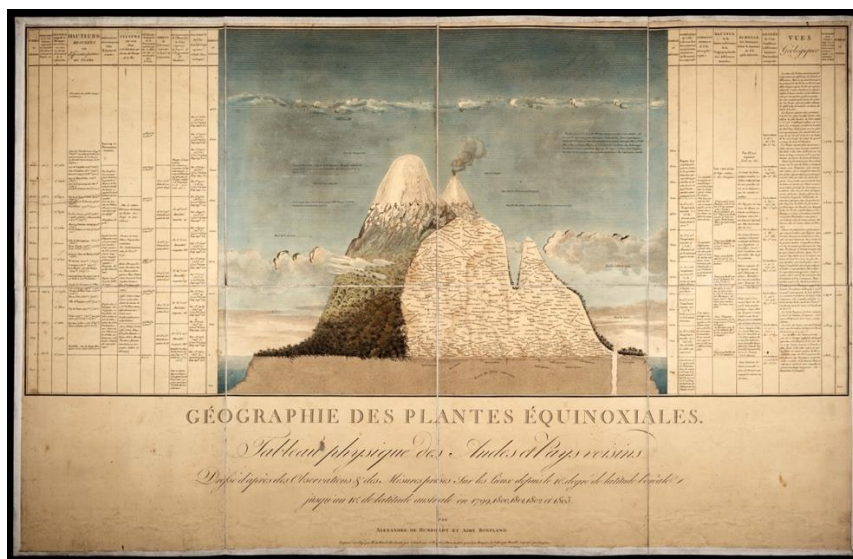


Figure 1. Géographie des plantes équinoxiales, from Humboldt’s *Essai sur la géographie des plantes accompagné d’un tableau physique des régions équinoxiales* (1805).

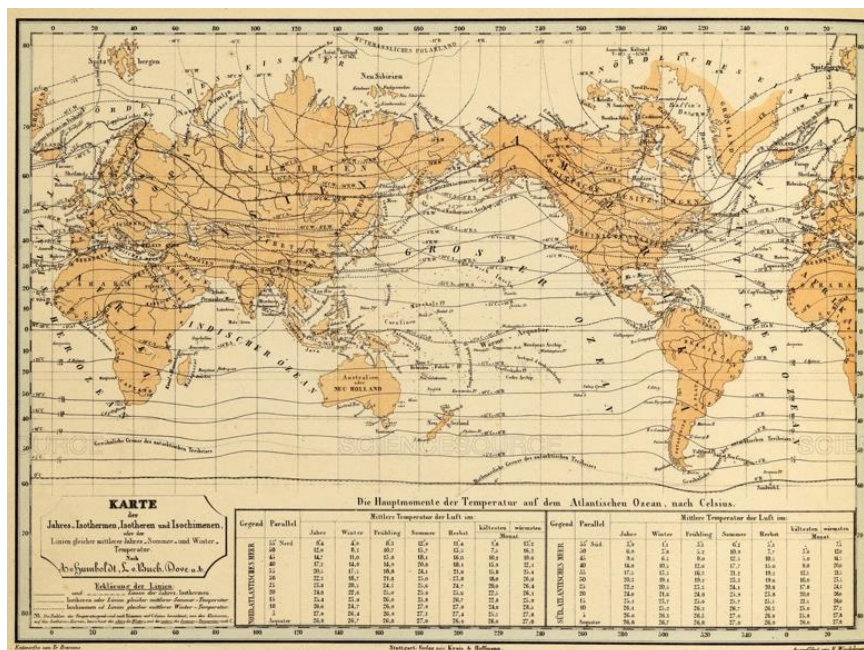


Figure 2. Isothermal map of the world, from Humboldt’s *Kosmos* (1845).

But nature can also reveal herself to mankind through aesthetic perception. «Everywhere - Humboldt continues - the mind is penetrated by the same sense of the grandeur and vast expanse of nature, revealing to the soul, by a mysterious inspiration, the existence of laws that regulate the forces of the universe».³⁸ In other words, the idea of the unity of nature, which man immediately and aesthetically senses, despite being immersed in the multiplicity and variety of natural

³⁸ Ivi, p. 25.

phenomena, can be rationally regained by his intellect, through the observation and the empirical examination of reality.

Furthermore, Humboldt is convinced that all natural phenomena, in relation to each other in space, will never remain the same if viewed over time, because time has a direction and, consequently, the Cosmos has a past, a present and a future, and therefore a history. For this reason, according to Humboldt, it will be impossible for man the understanding of nature in its organic unity if the study of its phenomena, and the related forces involved in their implementation, is limited to the strict framework of their current causal relations, forgetting their mysterious and admirable becoming.

But if we would correctly comprehend nature, we must not entirely or absolutely separate the consideration of the present state of things from that of the successive phases through which they have passed. We can not form a just conception of their nature without looking back on the mode of their formation. It is not organic matter alone that is continually undergoing change and being dissolved to form new combinations. The globe itself reveals at every phase of its existence the mystery of its former conditions.³⁹

Assimilated Humboldt's organismic view of nature, at the same time *systemic* and *historical*, both Darwin and Wallace clearly recognized how important for the understanding of the distribution and the origin of species is the study of the close interactions and influences between peculiar environmental features and living beings, and among living beings themselves. Thus, they faced the problem of the evolution of the organic world from the spatial (biogeographic) point of view, and this was certainly the key that allowed them to pave the way to the discovery of natural selection. In fact, by methodically exploring various contiguous areas, both naturalists could easily be witnesses of the work that evolution actually does on a time scale. For instance, Wallace, just returned from the Amazon, concluded one of his first papers with the following words:

On this accurate determination of an animal's range many interesting questions depend. Are very closely allied species ever separated by a wide interval of country? What physical features determine the boundaries of species and of genera? Do the isothermal lines ever accurately bound the range of species, or are they altogether independent of them? What are the circumstances which render certain rivers and certain mountain ranges the limits of numerous species, while others are not? None of these questions can be satisfactorily answered till we have the range of numerous species accurately determined.⁴⁰

Trying to answer these questions, some years later he concluded that «*Every species has come into existence coincident both in time and space with a pre-existing closely allied species*».⁴¹ in other words, the geographical distribution of living beings is explained by their descent from common ancestors.

Concerning Darwin's and Wallace's trust in evolution and their discovery of *Natural selection* as the main mechanism responsible of the transmutation and the origin of new species, it might be possible that, beside the great influence of Humboldt's organismic and historical

³⁹ Ivi, p. 72.

⁴⁰ Wallace, 1852, pp. 109-110.

⁴¹ Wallace, 1855, p. 195. Italic of the author.

worldview just discussed, some encouragements may have also come from some occasional 'evolutionary' hints present in his own writings. In fact, close to the ideas of the French naturalists Jean-Baptiste de Lamarck (1744-1829) and Étienne Geoffroy Saint-Hilaire (1772-1844), Humboldt had serious doubts about the fixity of the species. For instance, in *Aspects of Nature* (*Ansichten der Nature*, 1808) he writes that «If the proportion between land and sea, and even the height of the aerial ocean and its pressure, have not always been the same, the physiognomy of nature and the dimensions and forms of organized beings must also have been subjected to various alterations».⁴² And, a few pages later:

Those who are fond of imagining gradual transformations of species, and suppose the different kinds of parrots proper to two islands not far removed from each other to present examples of such a change, will be inclined to attribute the remarkable similarity [...] to a migration of species, which, having been the same at first, have been altered gradually by the long continued action of climatic causes during thousands of years, so that their identity being lost they appear to replace each other.⁴³

To point out the possible support of Humboldt's writings in the development of Darwin's evolutionary thinking, the historian Andrea Wulf reports that on the margins of the pages of his copy of the fifth volume of Humboldt's *Personal Narrative* - where the struggle among capybaras (the world's largest rodents) and their predators, crocodiles and jaguars, is described - Darwin somehow expressed for the first time his thoughts about his «theory by which to work»,⁴⁴ by noting in pencil: «What hourly carnage in the magnificent calm picture of Tropical forests» and «To show how animals prey on each other what a *positive* check».⁴⁵

In 1845, when *Cosmos* was issued, Wallace (unlike Darwin, who actually at that time, contrary to him, had already made his discovery), was particularly interested in Humboldt's authoritative viewpoint on evolution, as suggested by the following passage from a letter to his friend Bates: «As a further support to the *Vestiges* I have heard that *Cosmos* the celebrated work by the venerable Humboldt supports in almost every particular its theories not excepting those relating to Animal & Vegetable life - This work I have a great desire to read but fear I shall not have an opportunity at present».⁴⁶

⁴² Humboldt, 1849, vol. 2, p. 20.

⁴³ *Ivi*, p. 112.

⁴⁴ Darwin, 1958, p. 120.

⁴⁵ In Wulf, 2015, p. 276.

⁴⁶ Wallace to Bates, December 28, 1845. In Wallace, 1905, vol. 1, p. 256. The passage which Wallace refers to could be the following: «The series of organic types becomes extended or perfected in proportion as hitherto unknown regions are laid open to our view by the labors and researches of travelers and observers; as living organisms are compared with those which have disappeared in the great revolutions of our planet; and as microscopes are made more perfect, and are more extensively and efficiently employed. In the midst of this immense variety, and this periodic transformation of animal and vegetable productions, we see incessantly revealed the primordial mystery of all organic development, that same great problem of *metamorphosis* which Goethe has treated with more than common sagacity, and to the solution of which man is urged by his desire of reducing vital forms to the smallest number of fundamental types». Also the following passage has an interesting evolutionary flavor: «In the exposition of the terrestrial portion of the *Cosmos*, it will occasionally be necessary to descend to very special facts; but this will only be in order to recall the connection existing between the actual distribution of organic beings over the globe, and the laws of the ideal classification by natural families, analogy of internal organization, and progressive evolution». Humboldt, 1858, vol. 1, p. 41 and p. 60, respectively.

In conclusion, it may not be too far from the truth that it was by the passionate reading of Humboldt's books, by following his footsteps in the tropics and, above all, by applying his organismic approach to nature - known today as *Humboldtian science* - that Darwin and Wallace were able to seize how inorganic environment, species, populations and individuals each have an impact and influence on others in myriad ways hardly imaginable. Hence, they were led to recognize the key role played by Malthusian positive checks to counteract the geometrical growth of populations, and to point out *Natural selection* as the «effective cause of the continuous modification and adaptation of living things».⁴⁷

But after two centuries, Humboldt's view of nature has not ceased to be current, and, together with scientists of the past, we too, in our days, can still call ourselves *Humboltians*, if we consider that his concept of world as a 'global system' is the founding principle of modern ecological and environmental thought. A concept of nature to which mankind, afflicted by overpopulation, environmental crises and global warming, must strongly adhere if he does not want to succumb to his myopia.

REFERENCES

- Crick F., 1994. *The Astonishing Hypothesis: The Scientific Search for the Soul*. Charles Scribner's Sons, New York.
- Darwin C. & Wallace A.R., 1858. On the Tendency of Species to form Varieties; and on the Perpetuation of Varieties and Species by Natural Means of Selection. *Zoological Journal of the Linnean Society* 3: 46–62.
- Darwin C., 1958. *The autobiography of Charles Darwin 1809-1882. With the original omissions restored. Edited and with appendix and notes by his grand-daughter Nora Barlow*. Barlow N. ed., Collins, London.
- Darwin C., 1959. *The Life and Letters of Charles Darwin*. 2 vols., Darwin F. ed., Basic Books, New York.
- Darwin C., 1988. *Charles Darwin's Beagle Diary*. Keynes R. D. ed., Cambridge University Press, Cambridge.
- Humboldt A. von, 1814, 1819, 1825. *Voyage aux régions équinoxiales du Nouveau Continent: fait en 1799, 1800, 1801, 1803 et 1804 par Al. de Humboldt et A. Bonpland; rédigé par Al. de Humboldt. Relation Historique. 3 voll. (vol. 1: 1814, vol. 2: 1819, vol. 3: 1825)*, Shoell, Maze, Smith, Paris. English translation: *Personal Narrative of Travels to the Equinoctial Regions of the New Continent, during the years 1799-1804 by Alexander von Humboldt and Aimé Bonpland, written in French by Alexander von Humboldt; translated and edited by Helen Maria Williams*, 7 vols. Longman, Hurst, Rees, Orme, and Brown, London (1814-1829).
- Humboldt A. von, 1849. *Aspects of Nature, in Different Lands and Different Climates; With Scientific Elucidation*. 2 vols., J. Murray, London.
- Humboldt A. von, 1858. *Cosmos: A Sketch of the Physical Description of the Universe*, translated from German by E. C. Otté. 5 vols., Harper & Brothers, New York.

⁴⁷ In 1908, during the celebration of the 50th anniversary of the discovery of Natural selection, held at the Linnean Society, Wallace said: «[...] both Darwin and myself, at the critical period when our minds were freshly stored with a considerable body of personal observation and reflection bearing upon the problem to be solved, had our attention directed to the system of *positive checks* as expounded by Malthus in his 'Principles of Population'. The effect of this was analogous to that of friction upon the specially-prepared match, producing that flash of insight which led us immediately to the simple but universal law of the 'survival of the fittest', as the long-sought *effective* cause of the continuous modification and adaptation of living things». A. R. Wallace, *Acceptance Speech on Receiving the Darwin-Wallace Medal*, in *The Darwin-Wallace Celebration Held on Thursday, 1st July 1908, Linnean Society of London (1909)*, pp. 5-9. It is worth mentioning that the scientific hypothesis of the 'origin of species by means of natural selection', before appearing in Darwin's *Origin of Species* in 1859, was read for the first time at the *Linnean Society* on July 1st 1858, and subsequently published in a joint publication by C. Darwin and A. R. Wallace (1858).

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- Humboldt A. von, 1860. *Letters of Alexander von Humboldt to Varnhagen von Ense from 1827 to 1858*. Rudd & Carleton, New York.
- Mayr E. 1982. *The Growth of Biological Thought: Diversity, Evolution, and Inheritance*. Harvard University Press, Cambridge (MA).
- Richards R.J., 2002. *The Romantic Conception of Life. Science and Philosophy in the Age of Goethe*. The University of Chicago Press, Chicago.
- Secord J.A., 2000. *Victorian sensation: the extraordinary publication, reception, and secret authorship of Vestiges of the natural history of Creation*. University of Chicago Press, Chicago.
- Théodoridès J., 1966. Humboldt in England. *The British Journal for the History of Science* 3: 39–55.
- Wallace A.R., 1852. On the monkeys of the Amazon. *Proceedings of the Zoological Society of London* 20: 107–110.
- Wallace A.R., 1853. *A Narrative of Travels on the Amazon and Rio Negro*. Reeve & Co. London.
- Wallace A.R., 1855. On the Law Which Has Regulated the Introduction of New Species. *Annals and Magazine of Natural History* 16: 184–196.
- Wallace A.R. 1869. *The Malay Archipelago: the land of the orang-utan, and the bird of paradise*. Harper & Brother, New York.
- Wallace A.R., 1905. *My life: a record of events and opinions*. 2 vols., Chapman & Hall, London.
- Wulf A., 2015. *The Invention of Nature: Alexander von Humboldt's New World*. Knopf, New York.

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