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# **From Science to Cosmos**

## **What We Can Learn Today from Alexander von Humboldt**

Conference Paper given at the Humboldt Colloquium  
*Research without Borders – Alexander von Humboldt’s Legacy Today*  
Plenary Session ‘Research in the Spirit of Alexander von Humboldt – Sharing Experiences on  
What Makes the Difference for Successful Scientific Co-operations and Networks’

by

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After his meeting with Alexander von Humboldt in 1826, Goethe wrote in a happy mood that this many-sidedness man “has not his equal in knowledge and living wisdom. (...) He is like a fountain with many spouts, under which you need only hold a vessel; refreshing and inexhaustible streams are ever flowing.”<sup>1</sup> Considering the development of science since the early 19<sup>th</sup> Century, to what extent Humboldt’s work is still relevant today?

### **Humboldt measuring the world for the progress of science**

As presented in the novel of Daniel Kehlmann,<sup>2</sup> Alexander von Humboldt was concerned with the measurement of the world and constantly took readings during his journeys. All that is noticed in his *Reisetagebücher*, diaries which are likely to contain the world, according to the title of Marie-Noëlle Bourguet’s book: *Le monde dans un carnet*. This can be illustrated by the writing posture held by Humboldt on Eduard Hildebrandt’s painting, depicting him in his office in Berlin. Humboldt was fully aware of the role of Enlightenment for the development of science. In 1799 in Madrid, when the king gave him the permission to undertake his American journey of exploration in territories under Spain’s control, he appreciated a decision taken with the “liberality of ideas which characterizes our century, and to which we owe the rapid progress of human knowledge.”<sup>3</sup> Convinced that all results of observation can be reduced to numerical relations,<sup>4</sup> Humboldt wrote to Gotthelf Fischer von Waldheim on March 20, 1837: “J’ai la fureur des chiffres exacts”.<sup>5</sup> Furthermore, he was proud of his instrument-based scientific approach as shown particularly in the paintings on which he is depicted. Eduard Ender represents Bonpland and Humboldt in the Amazon with their scientific instruments, which enabled them to make multiple in-situ measurements. Friedrich Georg Weitsch draws Humboldt showing a sextant to a Native American at the bottom of Mount Chiborazo.

### **Humboldt as a successful scientist: his main discoveries and innovations**

Humboldt is exemplary because he did research with a great scientific rigor. He was very successful regarding his discoveries and innovations, among others:

- the theory concerning the periodic swarm of meteors and the rain of shooting stars of the Leonid meteor;
- the discovery of the fluvial system Amazon/Orinoco in its complexity;

- the law of the decrease in mean temperature with the increase in elevation above the sea-level;
- the opening of new research fields as geography of plants, scientific orography (*wissenschaftliche Gebirgskunde*), or early American studies (*Altamerikanistik*);
- the invention of isotherm lines.

### **Humboldt's vision of cosmos**

However, Humboldt's work is not reducible to one of these innovations or discoveries: it is driven by his vision of cosmos, which is also the title of his *opus magnum*. The use of this notion, with its metaphysic connotations, may seem surprising and far away from all scientific approach. But Humboldt moved away from speculations, like those of Kepler f.e. concerning the analogy between musical interval ratios and distances between planets. In line with the Enlightenment reason, he retains only the poetic character of the Harmony of the Spheres: the *aura caelestis* as the subtle and serene air that fills the world<sup>6</sup>. So he manages to separate what is scientific from other and more poetic considerations.

### **The Humboldtian cosmos at the origin of ecology**

Humboldt's cosmos is characterized by unity in diversity. No plant, no animal can be considered as an isolated specimen. Instead of classifying them into many categories, he splits them according to the climate and their environment<sup>7</sup>. Each one belongs to the complex network of life. Ernst Haeckel, the founder of ecology as a "science of the relations of an organism with its environment", borrowed to Humboldt the idea of a coherent whole constituted by complex interactions<sup>8</sup>. Linked with ecology, this notion of cosmos remains topical. So Humboldt discovered the idea of the 'keystone species' long before Robert Paine forged the concept in 1969. It refers to a species with a large effect on its natural environment. Regarding the Mauritia palm, the so-called 'tree of life', Humboldt and Bonpland "observed with astonishment how many things are connected with the existence of a single plant"<sup>9</sup>. This palm perfectly symbolizes the nature as a living organism<sup>10</sup>. Furthermore, Humboldt was the first to explain the crucial role of the forest in humidifying the atmosphere, holding the water, and protecting the soil against erosion<sup>11</sup>. Already in his day, Humboldt warned of harmful consequences of deforestation caused by human activity on future generations:

"By cutting down the trees that cover the summit and the side of the mountains, men in all climates seem to bring upon future generations two calamities at once – a want of fuel and a scarcity of water"<sup>12</sup>.

This is one more reason to see in Humboldt a precursor of ecology<sup>13</sup>. What a pity that even the glacier of the Pico Humboldt, located in the Andes and named after him, will melt quickly and should disappear shortly!

### **The Humboldtian geography: connecting science, cosmopolitics and geo-poetics**

But beyond nature, Humboldt was aware that social, economic and political problems are intrinsically linked to environmental issues<sup>14</sup>. For him, all the natural, cultural and social phenomena are interdependent: continents, oceans, atmosphere, vegetation, stars, visions of the world and the arts. He considers these elements as a whole. Humboldt gradually develops his vision of the cosmos starting from what Laure Péaud calls a "connective geography", a geography considering its relationship to the world, based on the interactions between all natural and social facts.

This new vision connects fields as different as cosmopolitics, physical description of the world, and geo-poetics. The physical description of the world (*physische Weltbeschreibung*)

represents a science of the whole, at the interface of humans and nature, shaped by both social and natural facts.

Cosmopolitics mean for Humboldt the concrete and political application of his project, namely the transmission of knowledge useful to human beings and governments to ensure the progress of humanity. Works as *Cosmos* are written to be understood by scientists and amateurs. From this point of view, Humboldt pursues one of the Enlightenment ideals, that knowledge, to make sense, shall be communicated to the people. For Humboldt, if the dissemination of knowledge must be useful, it is not necessarily the case of science itself, which shall exist outside of any utilitarian function:

“In an age when fruits are often expected before flowering and much people seem to despise things because they do not directly heal wounds, fertilize the field, or drive the wheels of the mill (...) we forget that sciences have an inner purpose and we lose sight of its literary interest, the aspiration for knowledge as knowledge. Mathematics cannot lose its dignity if it is regarded as the mere object of speculation, as inapplicable to solve practical tasks. Anything that extends the boundaries of our knowledge and offers to the mind new objects of perception or new relationships between what is perceived is important.”<sup>15</sup>

Connective geography is also linked with geo-poetics, a domain at the crossroads of *Natur-* and *Geisteswissenschaften*, apparently unusual for a scientist as him. But didn't he claim to be a “man of letters” in his correspondence with Arago?<sup>16</sup> As shown by Soraya Nour, Humboldt is close to the romanticist notion of ‘prescientific’ sympathy: for him, confused feelings, sensible intuition and reason are linked. Measuring nature does not cause necessarily its disenchantment and complete rationalization. Therefore, a book on nature must contain its objective as well as subjective side: our inner world is constructed by the impressions that nature provokes in us.

### **Humboldt's large-scale synthesis connecting worlds**

Is this recourse to sensibility and emotion really compatible with the supposed rationality of an Enlightenment man like Humboldt? Perhaps his opinion had changed after returning from his travel in America, during a time marked by the dissemination of *Naturphilosophie*. At the end of the 18<sup>th</sup> Century, Humboldt seems to be close to the ideas of Enlightenment. This is the case during the journey he did with Georg Forster on the Rhine, the Netherlands, England and France, from March 25 to July 11, 1790. Both were enthusiastic in the revolutionary Paris and went to the preparations for the Festival of the Federation at the Champ de Mars. This remarkable event suggested to him following lines: “The spectacle of the Parisians, their national gathering, that of their Temple of Liberty still unfinished for which I transported myself and, all that floats in my soul like a dream”.<sup>17</sup> This commitment during the French Revolution will continue to feed Humboldt's fight against slavery, oppression of native people in Latin America, persecution of political opponents and Jews in Prussia.

But in parallel with his commitment to the humanist values of the Enlightenment, Humboldt's holistic approach may be attributed, even partially, to the impact of *Naturphilosophie*.<sup>18</sup> Didn't Humboldt send his “Ideas Towards a Geography of Plants” to Schelling? But can we see him primarily as belonging to the romanticism? Opinions are much divided among critics: some asserting his belonging above all to Romanticism or enlightenment; some see a balance between both types of thought.<sup>19</sup> This is the case of Soraya Nour for whom Humboldt's project contributes to giving nature and life their place beside reason, to restore balance between them, without the supremacy of one over the other.<sup>20</sup>

So Humboldt realized the synthesis of the main European ideas of his time, while immersing himself in the experience of his long-distant journeys and the research conducted on this occasion. According to Ottmar Ette, the *Biblioteca Americana* Humboldt compiled and studied for many decades contributed to the emergence of a New World discourse.

Considering the broadness of his horizon, there is no doubt that he was able to bring different worlds together.<sup>21</sup>

### **Forster and Humboldt: towards mobility of knowledge**

What's about the origin of this large-scale cross-disciplinary research? Doesn't it derive from Georg Forster? The latter's travelogue *Ansichten vom Niederrhein* (Views of the Lower Rhine), written after his trip with Humboldt, gathers very diverse considerations about landscapes and their inhabitants, political and economic relations, arts and religions. That is, indeed, very close to Humboldt's global approach. As a matter of fact, Humboldt refers himself to Forster in the Preface of his *Essay on the Geography of Plants*:

"I conceived of this book during my earliest years. I gave a first sketch of a *Geography of Plants* in 1790 to Cook's famous colleague, Mr. Georges Forster, which whom I had close ties of friendship and gratefulness."<sup>22</sup>

In *Cosmos*, Humboldt pays homage again to Forster as the one who ushered in a new era in scientific travel:

"Through his influence there dawned a new era of scientific travel, having for its aim the comparison of various peoples and countries. Endowed with a keen aesthetic sense, and an imagination enriched by the freshly alive scenes presented to him by Tahiti and other happy islands of the Southern Seas, Georges Forster describes with a peculiar charm the varied glories of vegetation, the conditions of climate, the varieties of food in connection with the different habits of men (...). In his works we see the reflection of a mind characterized by originality, a love of truth, and an observant thoughtfulness, a mind replete with images derived from a view of Nature in her exotic loveliness."<sup>23</sup>

Humboldt borrows the term views (*Ansichten* or *Vues*) from Forster's *Ansichten vom Niederrhein* and use it in some of his own publications: *Ansichten der Natur* (1808), *Vues des cordillères et monumens des peuples indigènes de l'Amérique* (1810-1813). Ottmar Ette connects the plural of these titles with "the fundamental infinitude of knowledge and science", and "the open, unfinished character of his own thought, writing and publications". For him, new "views of culture" are always superimposed on each other, to give birth to literary images in motion. The notion of *Ansichten* can be understood in the sense of a mobility of knowledge in the construction of a world to be continuously reinvented.<sup>24</sup>

This mobility also affects languages and disciplines. Humboldt wrote plenty of letters in different languages to people from different disciplines and cultural areas.<sup>25</sup> His works were written in French, German and Latin, but contain quotes and annotations in the most diverse languages of the Western world as well as idioms from other cultural areas. For him, no language is likely to represent everything. Doing so requires writing between worlds and languages, i.e. the 'reflected multilingualism' considered by Ottmar Ette as a challenge for the 21<sup>st</sup> century.<sup>26</sup> Another challenge for our time is interdisciplinarity. Humboldt merely personified it better than anyone, he, who considered himself as a stranger between scientific disciplines.

### **Humboldt visionary**

Humboldt was not only a great scientist of his time, but also a visionary: his notion of cosmos is close to our ecological and planetary thought, taking in account the interdependency of all natural, cultural and social phenomena. His large-scale synthesis was based on a mobility of knowledge between cultures, languages and disciplines, which can be regarded as a nowadays challenge. If Wilhelm von Humboldt is broadly recognized as the father of the modern research university, perhaps his brother Alexander is well destined to build the philosophical basis for the University of the Future. Anyway, an actualization of his vision may be crucial for our own society facing the major issues of the planet.

Thanks to his great voyages of discovery in America and Russia, Humboldt was one of the few scientists of his day fully understanding the challenges of the second phase of accelerated globalization as defined by Ottmar Ette.<sup>27</sup> His five-year trip to and across America is one of the first expeditions without a colonization purpose and fully funded by his own resources.<sup>28</sup> By travelling, he was able to explain the disastrous consequences of colonial exploitation on both environment and human beings. Do we need a new Humboldt to understand the issues of our current phase of accelerated globalization? Yesterday as much as today, it is important to remember that the protection of environment is closely linked to economic development, but also to social issues concerning the whole population.<sup>29</sup>

I will finish with Humboldt's notion of star friendship by referring to two of his quotes. In the first one, he calls Forster as the "brightest star of his youth"; in the second one, he salutes the Southern Cross, when he discovers it for the first time, as "a friend of whom we would have been separated for a long time." For Sonja Neef, Humboldt's stellar friendship is not necessarily built on proximity, but on distance, on an unfamiliar familiarity (*eine unvertraute Vertrautheit*)<sup>30</sup>. Indeed, if the journey with Forster was an unforgettable experience for Humboldt, the relationship between the two men was not always so easy. Despite these communication difficulties, the friendship with Forster brought him a lot. A comparable otherness appears between the nature and us. The starry sky or the view of the earth from the space that fascinates and shows also our vulnerability and that of the earth. Gayatri Chakravorty Spivak opposes globalization, which everywhere imposes the same system of exchange, and the planet as a unified natural space, a kind of otherness that we inhabit and on which we depend. It is necessary today to rethink Humboldt's stellar friendship in its two dimensions: the intercultural dialogue and our relationship with the planet as a place to dwell that remains to be built<sup>31</sup>.

## Notes

<sup>1</sup> Quoted by Nicolaas A. Rupke, *Alexander von Humboldt, A Metabiography*, Bern, Peter Lang, 2008, p. 46.

<sup>2</sup> Daniel Kehlmann, *Die Vermessung der Welt*, Hamburg, Rowohlt Verlag, 2005.

<sup>3</sup> Alexandre de Humboldt to the editor-in-chief of the *Journal de Bordeaux*, 24 thermidor an XII (12 August 1804), quoted in: *Lettres américaines d'Alexandre de Humboldt (1798-1807)*, Paris, E. Guilmoto, ca. 1905: "Il est connu que je ne suis venu à Madrid l'an 1799 qu'afin d'y solliciter la permission de la Cour pour faire à mes propres frais des recherches dans les vastes colonies soumises à l'Espagne. Cette permission m'a été accordée avec cette libéralité d'idées qui caractérise notre siècle, et à laquelle on doit le progrès rapide des connaissances humaines".

<sup>4</sup> "Fast alle Resultate der Beobachtung sind einer Zurückführung auf Zahlenverhältnisse fähig" (*Kosmos*, p. 374).

<sup>5</sup> Eberhard Knobloch, *Alexander von Humboldt: The explorer and the scientist*, presidential address on the occasion of the second congress of the European Society for the History of Science in Cracow, Poland, 8 September 2006, p. 1.

<sup>6</sup> Humboldt, *Kosmos. Entwurf einer physikalischen Weltbeschreibung*, dir. Ottmar Ette et Olivier Lubrich, Frankfurt/M., Eichborn Verlag, 2004, p. 557.

<sup>7</sup> Andrea Wulf, *L'invention de la nature. Les aventures d'Alexander von Humboldt*, Lausanne, Les Éditions Noir sur Blanc, 2017, p. 138.

<sup>8</sup> Wulf 2017, p. 414.

<sup>9</sup> Alexander von Humboldt & Aimé Bonpland, *Personal Narrative of Travels. To the Equinoctial Regions of the New Continent, during the Years 1799-1804*, volume 6, Cambridge, Cambridge University Press, p. 7.

<sup>10</sup> Wulf 2017, p. 117.

<sup>11</sup> Wulf 2017, p. 95.

<sup>12</sup> *Voyage aux régions équinoxiales du Nouveau Continent...*, livre 5, Paris, N. Maze, 1820, p. 172/3. "En abattant les arbres qui couvrent la cime et le flanc des montagnes, les hommes, sous tous les climats, préparent aux générations futures deux calamités à la fois, un manque de combustible et une disette d'eau".

<sup>13</sup> Wulf 2017, p. 455.

<sup>14</sup> Wulf 2017, p. 157.

<sup>15</sup> Cf. Soraya Nour, “Le cosmos et le cosmopolitisme d’Alexander von Humboldt”, *Le Soi et le Cosmos d’Alexander von Humboldt à nos jours*, ed. Soraya Nour & Damien Ehrhardt, Berlin, Duncker & Humblot, 2015, p. 27: “In einem Zeitalter, wo man Früchte oft vor der Blüte erwartet und vieles darum zu verachten scheint, weil es nicht unmittelbar Wunden heilt, den Acker düngt, oder Mühlräder treibt, (...) vergisst man, dass Wissenschaften einen inneren Zweck haben und verliert das eigentlich literarische Interesse, das Streben nach Erkenntnis, als Erkenntnis, aus dem Auge. Die Mathematik kann nicht von ihrer Würde einbüßen, wenn sie als blosses Objekt der Spekulation, als unanwendbar zur Auflösung praktischer Aufgaben betrachtet wird. Alles ist wichtig, was die Grenzen unseres Wissens erweitert und dem Geist neue Gegenstände der Wahrnehmung oder neue Verhältnisse zwischen dem Wahrgenommenen darbietet”.

<sup>16</sup> Alexander von Humboldt to Arago, 20 August 1827 : “il me paraissait utile de prouver que ma première ambition est celle d’un homme de lettres”.

<sup>17</sup> “Le spectacle des Parisiens, leur rassemblement national, celui de leur temple de la Liberté encore inachevé pour lequel j’ai transporté moi-même du sable, tout cela flotte dans mon âme comme un rêve”.

<sup>18</sup> *Essay on the Geography of Plants*, Edited with an Introduction by Stephen T. Jackson, translated by Sylvie Romanowski, Chicago & London, The University of Chicago Press, 2009, p. 178.

<sup>19</sup> *Essay on the Geography of Plants*, p. 181: “Opinions are very divided among critics, some putting Humboldt in the Romantic camp (for example Richards, Tresch), some asserting his belonging to the Enlightenment and minimizing his Romantic affinities (e.g. Cannon, Minguet), for example: ‘One principle prevails: one must measure, weigh, calculate the phenomena of nature . . . Humboldt studies the myriad aspects of nature in America, remaining faithful to the rational empiricism that he constantly referenced’ (Minguet 1997, 377). Many see a balance between both types of thought (e.g., Bowen, Castrillon, Minguet, Nicolson, Reill, and Wise and Wise): ‘Humboldt, although always alive to the prerogatives of aesthetics and the appeal of the sublime, did not follow Schiller or Schelling in subordinating rationality to aesthetic sensibility. . .’.

<sup>20</sup> Nour 2015, p. 18

<sup>21</sup> Ottmar Ette, “Die Aktualität Alexander von Humboldts. Perspektiven eines Vordenkers für das 21. Jahrhundert”, *Études germaniques*, n° 261/1, 2011, p. 135: “Er hatte in seiner über lange Jahrzehnte erarbeiteten Biblioteca Americana die Schriften eines Clavijero oder Sigüenza y Góngora studiert und kannte die Denktraditionen, in denen sie seit Chimalpain oder Garcilaso de la Vega el Inca standen“.

<sup>22</sup> *Voyage de MM. Alexandre de Humboldt et Aimé Bonpland. Essai sur la Géographie des plantes : accompagné d’un tableau physique des régions équinoxiales*, Paris, Levrault, Schoell et Compagnie, Libraires, 1805, p. VI.

<sup>23</sup> Alexander von Humboldt, *Kosmos, Entwurf einer physischen Weltbeschreibung*, dir. Ottmar Ette et Olivier Lubrich, Frankfurt/M., Eichborn Verlag, 2004, p. 223: “Durch ihn begann eine neue Aera wissenschaftlicher Reisen, deren Zweck vergleichende Völker- und Länderkunde ist. Mit einem feinen ästhetischen Gefühle begabt, in sich bewahrend die lebensfrischen Bilder, welche auf Tahiti und anderen damals glücklicheren Eilanden der Südsee seine Phantasie (...) erfüllt hatte; schilderte Georg Forster zuerst mit Anmuth die wechselnden Vegetationsstufen, die klimatischen Verhältnisse, die Nahrungsstoffe in Beziehung auf die Gesittung der Menschen nach Verschiedenheit ihrer ursprünglichen Wohnsitze und ihrer Abstammung. Alles, was der Ansicht einer exotischen Natur Wahrheit, Individualität und Anschaulichkeit gewähren kann, findet sich in seinen Werken vereint“.

<sup>24</sup> Ottmar Ette, “La pensée nomade. Alexander von Humboldt ou la science vivante”, *Les frères Humboldt et l’Europe de l’Esprit*, dir. Bénédicte Savoy & David Blankenstein, Paris, PSL Research University Jean-Pierre de Monza, 2014, p. 121.

<sup>25</sup> Ette 2011, p. 136.

<sup>26</sup> Ette 2011, p. 131.

<sup>27</sup> Ottmar Ette, *Alexander von Humboldt und die Globalisierung – Das Mobile des Wissens*, Frankfurt/M. & Leipzig, Insel Verlag, 2009, p. 13.

<sup>28</sup> Nour, 2015, p. 17-18.

<sup>29</sup> Wulf 2017, p. 453-4: “Comme le disait le poète-paysan américain Wendell Berry : ‘Il n’y a pas de différence entre l’état de la Terre et l’état des populations. Quand on la maltraite, les gens en souffrent.’ Ou, comme la militante canadienne Naomi Klein le déclare dans *This Changes Everything* (Tout peut changer, 2014), les intérêts de notre modèle économique sont en conflit avec ceux de l’environnement. Humboldt constatait que le colonialisme, qui reposait sur l’esclavage, la monoculture et l’exploitation, avait créé un système injuste et destructeur...”.

<sup>30</sup> “Unserer freudige Genugtuung beim Erscheinen des Südlichen Kreuzes wurde lebhaft von denjenigen unter der Mannschaft geteilt, die in den Kolonien gewohnt hatten. *In der Meereseinsamkeit begrüßt man einen Stern wie einen Freund, von dem man lange Zeit getrennt gewesen*. Bei den Portugiesen und Spaniern steigert sich

diese Anteilnahme noch durch besondere Gründe : religiöses Gefühl zieht sie zu einem Sternbild hin, dessen Gestalt an das Wahrzeichen des Glaubens mahnt, das ihre Väter in den Einöden der neuen Welt aufgepflanzt.”

<sup>31</sup> Cf. Sonja Neef, “L’incertitude dans l’histoire des idées cosmopolitiques et cosmographiques”, *Le Soi et le Cosmos d’Alexander von Humboldt à nos jours*, dir. Soraya Nour & Damien Ehrhardt, Berlin, Duncker & Humblot, 2015, p. 52.