

# THE QUESTION OF NATURE AND ITS RELATION TO THE EMPIRICAL SCIENCES IN GOETHE, HEGEL, AND HUMBOLDT\*

A QUESTÃO DA NATUREZA E SUA RELAÇÃO COM AS CIÊNCIAS EMPÍRICAS EM GOETHE, HEGEL  
E HUMBOLDT

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**RESUMO:** Neste ensaio, considero a questão da natureza no pensamento de Hegel e coloco sua obra em diálogo com a obra de Goethe e Alexander von Humboldt. Goethe, Hegel e Humboldt abordavam a questão da natureza e sua relação com as ciências. Nenhum desses pensadores acreditava que a natureza era o que as ciências naturais diziam que era. No entanto, Hegel era um filósofo, e sua visão da natureza surgiu da filosofia, não da ciência empírica: a filosofia era a verdade das ciências naturais. Hegel trabalha com uma hierarquia que coloca a filosofia e as verdades que ela pode revelar acima das ciências naturais. Essa hierarquia não está presente na obra de Humboldt e Goethe.

**PALAVRAS-CHAVE:** natureza, ciências empíricas, arte, Goethe, Humboldt

**ABSTRACT:** In this essay, I consider the question of nature in Hegel's thought and place his work into dialogue with the work of Goethe and Alexander von Humboldt. Goethe, Hegel, and Humboldt were each addressing the question of nature and its relation to the sciences. None of these thinkers believed that nature was whatever the natural sciences said it was. Yet, Hegel was a philosopher, and his view of nature grew from philosophy not empirical science: philosophy was the truth of the natural sciences. Hegel works with a hierarchy that places philosophy and the truths it can reveal above the natural sciences. This hierarchy is not present in the work of Humboldt and Goethe.

**KEYWORDS:** nature, empirical sciences, art, Goethe, Humboldt

## 1. Introduction

In light of the current political climate with its authoritarian tendencies and their accompanying apparatus of domination, we do well to revisit the work of Theodore Adorno a thinker whose critique of ideology continues to help us think through the social-political problems arising therefrom and to critique the pernicious, violent social patterns that emerge therewith. Adorno, in an act of rebellion against the style of philosophy conducted by canonical figures such as Kant and Hegel, was keenly interested in natural beauty, which he claimed, had been

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repressed by Hegel in the wake of Kant's *Critique of Judgment*. In *Aesthetic Theory*, Adorno claims that "[t]he concept of natural beauty rubs on a wound, and little is needed to prompt one to associate this wound with the violence that the artwork – a pure artifact – inflicts on nature."<sup>1</sup> In contrast to Kant and Hegel, Alexander von Humboldt's take on natural beauty is lauded by Adorno, who tells us that:

Humboldt occupies a position between Kant and Hegel in that he holds fast to natural beauty yet in contrast to Kantian formalism endeavors to concretize it...[H]e presents a critique of nature that, contrary to what would be expected one hundred and fifty years later has not become ridiculous in spite of its earnestness... Humboldt's descriptions of nature hold their own in any comparison.<sup>2</sup>

Adorno moves from reference to Humboldt's grasp of natural beauty to talk of Humboldt's critique of nature and finally to his descriptions of nature. This movement occurs in Humboldt's work as well as he discusses the beauties of nature, presents a critique of nature that is born of detailed descriptions of nature that come *insektartig*, from the ground up, filled with detailed empirical descriptions combined with *Naturgemälde*/portraits of nature that present the reader with a sense of the delights of nature's beauty. A vicious empiricism (*rohe Empirie*) is replaced by a tender empiricism (*zarte Empirie*).<sup>3</sup> Adorno finds great value in Humboldt's emphasis on natural beauty. In *Aesthetic Theory*, while lamenting the disappearance of natural beauty from the realm of aesthetics, Adorno emphasizes the significant consequences the idea of freedom and its place in a given philosophical system have upon the role of the subject in descriptions of the world. The disappearance of natural beauty from the realm of aesthetics was the result of what Adorno says was "the burgeoning domination of the concept of freedom and human dignity, which was inaugurated by Kant and then rigorously transplanted into aesthetics by Schiller and Hegel; in accord with this concept nothing in the world is worthy

<sup>1</sup>ADORNO, T. *Aesthetic Theory*. Trans. by R. Hullot-Kentor. Minneapolis, MN: University of Minnesota Press, 1997, pp. 61-62.

<sup>2</sup> *Ibid.*, p. 73.

<sup>3</sup> For more on the differences between Hegel and Humboldt's presentation of nature, see MILLÁN BRUSSLAN, E. *Naturphilosophie and the Problem of Clean Hands. Hegel and Alexander von Humboldt on Nature*. In: Bykova, M. (ed.). *Hegel's Philosophy of Nature. A Critical Guide*. Cambridge: Cambridge University Press, 2024, pp. 58-75.

of attention except that for which the autonomous subject has itself to thank.”<sup>4</sup> Adorno’s trenchant critique, one that indicts Hegel for the repression of natural beauty, recalls Hegel’s own critique in the preface of the *Differenzschrift* (1801):

[T]he dignity that is beginning to be accorded, more or less clearly or obscurely, to poetry and art in general in their true scope – indicate the need for a philosophy that will recompense nature for the mishandling that it suffered in Kant and Fichte’s systems, and set Reason itself in harmony with nature, not by having Reason renounce itself or become an insipid imitator of nature, but by Reason recasting itself into nature out of its own inner strength.<sup>5</sup>

As Illeterrati indicates, the *Differenzschrift*, with its “comparisons of the philosophies of Fichte and Schelling foregrounds the issues of nature and the relationship between subjectivity and nature.”<sup>6</sup> In this early phase of Hegel’s thought we see that Hegel connects the move to recompense nature with its proper value to a philosophy of poetry and art; yet he still insists that the saving touch will be offered by reason recasting itself into nature. This sort of recasting brings us precisely to the problem articulated by Adorno; even in the move towards nature that Hegel makes, even as he claims to be saving nature from its mishandling in the systems of Kant and Fichte, Hegel is not able to see nature as something independent of human reason or subjectivity. Hegel’s view of nature as developed in his later, *Encyclopedia of the Philosophical Sciences* (1817) continues with the view of nature as dependent on human subjectivity. As Terry Pinkard observes:

A genuine *Naturphilosophie*, Hegel says, is ... supposed to answer the question: what is nature. And the answer for Hegel, is not: nature is whatever natural science (physics, chemistry, biology) says is nature. For him, *Naturphilosophie* is part of philosophy, not empirical science, and it is not a competitor to natural science but is instead the “truth” of natural science in the sense that it shows what conception of nature must really be in play (and must itself be true) for the truths of the natural sciences to have the status they do. As it was for the rest of his dialectic, Hegel was not looking for whatever conception of nature was “presupposed” by the natural sciences, but for which conception of nature was the true conception that we had to develop in order

<sup>4</sup> ADORNO. *Aesthetic Theory*, p. 62.

<sup>5</sup> HEGEL, G.W.F. *Differenz des Fichteschen und Schellingschen Systems der Philosophie*. Hamburg: Felix Meiner Verlag, 1979, p. 5/*The Difference between Fichte’s and Schelling’s System of Philosophy*. trans. H.S. Harris and Walter Cerf. Albany, NY: State University of New York Press, 1977, p. 83.

<sup>6</sup> ILLETERRATI, L. Nature and Life in Hegel’s Early Writings. In: Corti, L. and Schülein, J.G. (eds.). *Nature and Naturalism in Classical German Philosophy*. New York: Routledge, 2023, p. 188.

to understand how it was that the various tensions resulting from the conception of nature that emerges from the natural sciences could be resolved.<sup>7</sup>

As we shall see, Goethe, Hegel, and Humboldt were each addressing the question of nature and its relation to the sciences. None of these thinkers believed that nature was whatever the natural sciences said it was. Yet, Hegel was a philosopher, and as Pinkard indicates, for him *Naturphilosophie* was part of philosophy *not* empirical science: philosophy was the truth of natural sciences. Hegel works with a hierarchy that places philosophy and the truths it can reveal *above* the natural sciences.

In contrast to Hegel, Goethe and Humboldt approach the question of nature from the ground up: *Geist* was not their touchstone. Goethe was *not* a philosopher, though in his capacity as the privy councilor of Weimar, he was responsible for hiring some of the luminaries of German Idealism at the University of Jena: Fichte, who worked there from 1794-1799, Schiller, whose tenure lasted from 1798-1802, and Hegel, who worked in Jena from 1801-1806. Goethe remained suspicious of any philosophical system that would tyrannically force nature to conform to a system of thought, *any* system of thought. Goethe appreciated Hegel's scientific and historical knowledge and his philosophical contributions. In other corners, appreciation for Hegel's philosophy of nature was slow to come, especially in the Anglo-phone world, and as we have seen, Adorno, a thinker inclined towards Hegel in other ways, was quite critical of Hegel's view of nature.<sup>8</sup>

Recent work on Hegel's Philosophy of Nature has presented a more charitable reading of it than the one offered by Adorno. Indeed, Stephen Houlgate opens his volume with claims that his excellent collection aims to dispel, namely: "G.W.F. Hegel's *Philosophy of Nature*, which forms the second part of his *Encyclopedia of the Philosophical Sciences* (1817, 1827, 1830), has long been the object of ridicule and disdain"<sup>9</sup> – leading to the view "all that the name 'Hegel' has signified to many during the last century and a half is an arrogant and ignorant German philosopher who denied evolution and who (in 1801) "proved" a priori that there could only be seven planets just as the asteroids were being discovered between the orbits of Mars

<sup>7</sup> PINKARD, T. **German Philosophy 1760-1860. The Legacy of Idealism.** Cambridge: Cambridge University Press, 2002, pp. 267-8.

<sup>8</sup> See ADORNO, T. **Hegel: Three Studies.** Trans. Shierry Weber Nicholson. Cambridge, MA: MIT Press, 1999. In these texts, Adorno's view that Hegel was a true revolutionary thinker is evident.

<sup>9</sup> HOULGATE. **Hegel**, p. xi.

and Jupiter.”<sup>10</sup> Marina Bykova’s well-balanced collection, *Hegel’s Philosophy of Nature*, likewise notes the negative reception of Hegel’s philosophy of nature and points us to “an increasing renunciation of the dismissive attitude towards Hegel’s philosophy of nature and a growing appreciation for its contents worthy of recognition in its own right.”<sup>11</sup> The essays in Bykova’s welcome collection showcase the growing appreciation for Hegel’s contributions to the philosophy of nature. Alison Stone’s work has also been of great service in opening new paths to Hegel’s Philosophy of Nature: Stone focuses on Hegel’s view of nature and its relation to the early German Romantics and to issues of gender and race.<sup>12</sup> Stone acknowledges that theory and concept take precedence in Hegel’s view of nature, writing, “Hegel explicitly denies that science is a purely empirical discipline, insisting that theory and conceptualization always inform scientific experimentation and observation (EN 1:193).”<sup>13</sup> Despite the recent surge of interest in Hegel’s Philosophy of Nature and the illuminating work that has resulted, the question of the status of Nature in Hegel’s philosophy and its relation to the empirical sciences remains worth investigating.

One way to understand Hegel’s philosophy of nature is to understand its relation to the rest of his philosophical system, that is, to analyze the relation between Nature and Spirit. Another promising line is to give an account of the relation between philosophy and the natural sciences in Hegel’s philosophy of nature. In what follows I shall seek to understand the relation between philosophy and the natural sciences in Hegel by placing Hegel’s philosophy of nature into dialogue with two scientifically minded thinkers of the period. My consideration will take us to the relation Hegel had to Goethe and Humboldt, two contemporaries who had a keen interest in the natural sciences and sought to expand the natural sciences so that, as Adorno noted, the beauties of nature could be considered. For Humboldt, understanding nature, appreciating its beauty, and describing this in order to present an accurate view of nature to his readers is not a matter of what the autonomous subject grants to nature, but rather a more Spinozistic position that we are just finite parts of an infinite whole that is much greater than we are: subjectivity and objectivity are balanced and blended in his account of the relation between art and science, and with this blending, empiricism is made more tender. In his tender empiricism,

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<sup>10</sup> Ibid., p. xi.

<sup>11</sup> BYKOVA, M. (ed.). *Hegel’s Philosophy of Nature*. Cambridge: Cambridge University Press, 2024, p. 3.

<sup>12</sup> See STONE, A. *Petrified Intelligence. Nature in Hegel’s Philosophy*. Albany: SUNY Press, 2005. and *Nature, Ethics, and Gender in German Romanticism and Idealism*. London: Rowman&Littlefield, 2018.

<sup>13</sup> STONE. *Nature, Ethics, and Gender*, p. 131.

Humboldt was in the good company of Goethe, a leading thinker and statesman of the period. Both Hegel and Humboldt had a close relation to Goethe. As Eckart Förster has argued in *The Twenty-Five Years of Philosophy*, Goethe belongs in the company of Kant, Fichte, and Hegel as one of the thinkers who shaped philosophy from 1781-1806, the years in which philosophy became a science (*Wissenschaft*).<sup>14</sup> Adding Humboldt to the conversation that took shape in German-speaking lands of the late 1700s and early 1800s will bring even more clarity to the question of nature and its relation to the empirical sciences.

Hegel, Goethe, and Humboldt share an interest in bringing us a view of nature that is in conversation with the developments of the natural sciences but not dictated by those sciences. They were each developing an art of science that was informed by developments in the empirical sciences but not limited to just those results. The art of science is one that relies on empirical investigation but is not limited by the empirical realm. I will begin with an account of Goethe and Hegel's differences vis-à-vis the view of nature, and Humboldt's place in their intellectual constellation.

## 2. *Tea with Hegel: Spiritual Sickness and the Remedy of Nature*

Goethe was familiar with Hegel's work and, courageous thinker that he was, even grappled with Hegel's philosophy. As M.J. Petry recounts in his introduction to Hegel's *Philosophy of Nature*, "[i]n a famous conversation recorded by Eckermann, Goethe tackled Hegel on the subject [of the dialectic] during the latter's visit to Weimar on October 18, 1827" (96). Petry cites Eckerman's account:

Hegel is here; Goethe has a very high esteem for him personally, though he does not greatly relish some of the fruits of his philosophy, and this evening he gave a tea party in his honour. In the course of the conversation, the nature of the dialectic was discussed.

'Basically, said Hegel, 'it is nothing more than the regulated and methodical cultivation of the spirit of contradiction, which is a gift common to everyone, and particularly valuable for distinguishing the true from the false.'

'But let us hope,' interposed Goethe, 'that such intellectual arts and skills are not too much misused for the purpose of turning falsehood into truth and truth into falsehood!'

'That does sometimes happen,' replied Hegel, 'but only with people who are spiritually sick.'

<sup>14</sup> FÖRSTER, E. *The Twenty-Five Years of Philosophy. A Systematic Reconstruction*. Trans. B. Bowman. Cambridge, MA: Harvard University Press, 2012.

‘Well,’ said Goethe, ‘I personally recommend the study of nature as preventive of that disease. For in nature we are dealing with something which is infinitely and eternally true, and which immediately rejects as inadequate everyone who does not show complete integrity and honesty in the way he observes and treats his subject. And I am certain that the study of nature would be a wholesome remedy for many a dialectical sufferer.’<sup>15</sup>

Humboldt, the period’s great student of nature, was just the sort of honest person of integrity Goethe had in mind. The earnestness referenced by Adorno comes to mind when we read Humboldt’s descriptions of nature. Goethe’s admiration for Humboldt’s work is found in many places. In *Elective Affinities* we find this reference to Humboldt in a comment by one of the characters in the novel, Otilie. Otilie claims that Humboldt is able to, “describe and represent the strangest and most exotic things in their locality, always in their own special element, with all that surrounds them.” Otilie is referring to Humboldt’s travel diaries, the result of his 5-year voyage to the equinoctial regions of the earth (1799-1804). Upon his return from Spanish America, Humboldt spent time in the “scientific capital” of his time, Paris (1804-1827), where he published his *Essai sur la géographie des plantes; accompagne d’un tableau physique des régions équinoxiales, Ideen zu einer Geographie der Pflanzen, nebst einem Naturgemälde der Tropenländer* (1807). The German edition of this book was dedicated to Goethe, and it has been described by Meyer-Abich as a “getreues geistesgeschichtliches Pendant” (a true intellectual-historical companion) to Goethe’s, *Die Metamorphose der Pflanzen* (1790). Meyer-Abich’s claim reveals an important link between the two works; Humboldt’s *Geography of Plants* and Goethe’s *Metamorphosis of Plants* share a methodological approach, and Humboldt’s *Essay on the Geography of Plants* is a kind of intellectual-historical counterpart to Goethe’s *Metamorphosis* text. In Humboldt’s work, nature emerges as a realm of freedom, that is, *not merely* as a realm to be dominated by humans (not by their autonomy or their subjectivity), but also as a set of phenomena to be appreciated. Humboldt defines nature as “the realm of freedom” (*Reich der Freiheit*) and he wanted his presentation of nature to keep the “living breath of nature” (*lebendiger Hauch der Natur*) alive. With this view of nature, the view of science shifts. If nature is the realm of freedom, it cannot be empirically mastered, so we bump up against the limits of empirical science and theory. That which is free can never be fully

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<sup>15</sup> HEGEL, G.W.F. **Hegel’s Philosophy of Nature**. Trans. and Ed. M.J. Petry. London: Goerge Allen and Unwin, 1970, pp. 96-97.

conceptualized, the realm as nature as the realm of freedom is in an eternal state of becoming and thus indeterminable.

Humboldt and Goethe had a close intellectual and personal relationship. The younger Humboldt was, in some ways, the accomplished and recognized scientist that the elder Goethe never quite became. Consider what Meyer-Abich claims in his introduction to Humboldt's *Ideen zu einer Geographie der Pflanzen*: "One is not guilty of overstatement about the natural sciences in the Age of Goethe, if one claims that Goethe was the inaugurator and Humboldt the person who perfected the natural sciences"<sup>16</sup> – this claim is part of a well-established pattern of discussing the scientific work of Goethe and Humboldt by way of a common historical horizon.

Humboldt moved from the empirically driven realm of the natural scientist (*Naturforscher*) to the realm of *Naturphilosophie*, which in his work emerges as way to present nature as a realm that can be dominated, but which is also, always, a realm of freedom, and so beyond the controlling grasp of the human, and certainly not a merely mechanical realm. Humboldt's writings on nature are an attempt to balance these two aspects of nature. Humboldt's path away from the purely empirical realm of nature delivers us to the aesthetic realm, which is a celebration of human subjectivity in its freedom. Humboldt's approach to nature did indeed embrace the subjectivity of the observer and with that embrace departed from a strictly empirical approach to nature. Yet, he did not allow the human subject to eclipse nature. In his work, Humboldt also pushed for an embrace of new landscapes and practices, providing a break from the typical Eurocentric rejections of America by so many of his contemporaries.

Humboldt's admiration for Goethe is explicit in words delivered at the *Versammlung Deutscher Naturforscher und Ärzte*, where he named Goethe as first patriarch (*erster Patriarch*) of the sciences. Humboldt told the audience that the great creations of Goethe's poetic fantasy (*dichterischer Phantasie*) had not kept him from immersing a researcher's gaze (*den Forscherblick*) into all of the depths of the life of nature (*alle Tiefen des Naturlebens*). Böhme points out that while Humboldt's deferential nod to scientists such as the astronomer Wilhelm Olbers (1758-1847), anatomist Thomas Sömmerling (1755-1830), or Humboldt's teacher in Göttingen, the well-known physiologist and natural historian, Friedrich Blumenbach (1742-

<sup>16</sup> HUMBOLDT, A. v. *Ideen zu einer Geographie der Pflanzen*, with an introduction by Adolf Meyer-Abich. Darmstadt: Wissenschaftliche Buchgesellschaft, 1977, pp. v-x, at p. ix. "Man sagt nicht zuviel über die Naturwissenschaft der Goethezeit, wenn man in Goethe nur ihren Inaugurator, in Humboldt aber ihren wirklichen Vollender sieht." My translation.

1840), was followed by details regarding their scientific contributions, his endorsement of Goethe's "Blick in die Tiefen des Naturlebens" (view into the depths of the life of nature) was delivered to the audience at the scientific gathering without further elaboration.<sup>17</sup> How can one elaborate on the *Blick in die Tiefen des Naturlebens*? One must fuse both the aesthetic and the scientific, have a sense for the art of science. The view into the depths of the life of nature would keep us connected to the empirical matter that can be observed, to an authentic, honest presentation of nature that will not lead to the spiritual sickness which both Goethe and Hegel wanted to avoid. The beauties of nature will not be seen by anyone whose eyes are closed. Let us now consider how Goethe and Humboldt brought nature into focus, that is, how they saw and presented nature.

### 3. *Blending Art and Science*

As Tim Mehigan and Peter Banki emphasize in their essay, "Goethe's Philosophy of Nature," Goethe was an "Augenmensch". David Wellbery and Eckhart Förster have also analyzed the central role that seeing/Sehen plays in Goethe's work.<sup>18</sup> As Mehigan and Banki observe, the characterization of Goethe as an "Augenmensch" "is useful in that it highlights a prominent aspect of Goethe's sensibility – his response to physical beauty and the strong emotions it arouses."<sup>19</sup> For Humboldt and for Goethe, the presentation of nature is both a scientific and an aesthetic task, that is, both the measurable/quantifiable aspects of nature *and* the qualities of nature that give rise to pleasure, inspiration, and delight need to be presented. Humboldt's view of nature is shaped by the desire to present the living forms of nature in their connection/unity with one another. He does this, in part, via a search for the elementary forms of nature. In *Kosmos*, he writes of a "desire of reducing vital forms to the smallest number of fundamental types/ "Bedürfnis nach einem idealen Zurückführen der Formen auf gewisse

<sup>17</sup> BÖHME, H. Goethe und Alexander von Humboldt. Exoterik und Esoterik einer Beziehung. In: Peters, B. (ed.). **Wechselwirkungen. Kunst und Wissenschaft in Berlin und Weimar im Zeichen Goethes**. Berlin: Peter Lang, 2002, p. 168.

<sup>18</sup> WELLBERY, D. Augenmensch: Zur Bedeutung des Sehens im Werk Goethes. **Deutsche Vierteljahrsschrift für Literaturwissenschaft und Geistesgeschichte** 75/1 (Sonderheft) (March 2002). FÖRSTER, E. Goethe and the 'Auge des Geistes.' **Deutsche Vierteljahrsschrift für Literaturwissenschaft und Geistesgeschichte** 75 (2001): pp. 87-101. See also NASSAR, D. **Romantic Empiricism. Nature, Art, and Ecology from Herder to Humboldt**. Oxford: Oxford University Press, 2022, pp. 127-130.

<sup>19</sup> MEHIGAN, T. and BANKI, P. Goethe's Philosophy of Nature. In: Millan Brusslan, E. (ed.) **The Palgrave Handbook of German Romantic Philosophy**. London: Palgrave-Macmillan, 2020, p. 375.

Grundtypen.”<sup>20</sup> Humboldt approaches this talk of the path to *Grundtypen* by explicit reference to Goethe’s work, writing, “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...”/In der Mannigfaltigkeit und im periodischen Wechsel der Lebensgebilde erneuert sich unablässig das Urgeheimnis aller Gestaltung, ich sollte sagen, das von Goethe so glücklich behandelte Problem der Metamorphose”.<sup>21</sup> As Humboldt observes, in *Die Metamorphose der Pflanzen* (1790), with the move to the *Urpflanze*, we have just such a move to the *Grundtypen* that are of interest to Humboldt in his quest to present the living forms of nature. Hartmut Böhme connects the work of Humboldt and Goethe via precisely this matter of the search for *Grundtypen* and *Urpflanzen*:

One can say, that the Cosmos-Idea, insofar as it is understood as a *Naturgemälde*/portrait of nature, that is, as sensible image of a complex manifold, has the same status as the Urphänomen in Goethe/Man kann sagen, daß die Kosmos-Idee, insofern sie als Naturgemälde, d.h. als sinnlichgenerisches Schema einer komplexen Mannigfaltigkeit von Natur, verstanden wird, bei Humboldt denselben Status hat wie das Urphänomen bei Goethe.<sup>22</sup>

The status of the *Urphänomen* in Goethe can be tracked in the account of the “Glückliches Ereignis” or conversation between Goethe und Schiller concerning the *Urpflanze* and the central question of how one “sees” original types/*Urtypen*? Are they seen only with the spiritual eye? Original Forms/Archetypes (*Urtypen* or *Archetypen*) of nature are not measurable, yet they form an essential element of understanding that which is measurable. The *Urtypen* remind the scientist that in order to understand Nature, one must go beyond charts and graphs.

*Darstellung* is not an uncomplicated term in the work of either thinker. With respect to Goethe’s work, Agnes Arber points out:

<sup>20</sup> Humboldt, A.v. *Cosmos. A Sketch of the Physical Description of the Universe*. Trans. E.C. Otté. Baltimore, MD: The Johns Hopkins University Press, 1997, 41/ *Kosmos. Entwurf einer physischen Weltbeschreibung, 5 Bde.* Stuttgart/Tübingen: J.G. Cotta, 1845-1862, p. 16.

<sup>21</sup> Humboldt. *Cosmos*, p. 41/Humboldt. *Kosmos*, p. 16. For more on the important connections between Goethe and Humboldt, see Meyer-Abich (*op.cit.*). Meyer Abich claims, for example, that “Humboldt kann als der Vollender der Naturforschung Goethes angesehen werden” (Meyer-Abich, p. 149).

<sup>22</sup> BÖHME, H. Ästhetische Wissenschaft. Aporien der Forschung im Werk Alexander von Humboldts. In: Ette, O., Hermanns, U., Scherer, B.M., Suckow, C. (eds.). *Alexander von Humboldt – Aufbruch in die Moderne*. Berlin: Akademie Verlag, 2001, p. 17. I have addressed the relation between Goethe and Humboldt in my essay, *The Quest for the Seeds of Eternal Growth: Goethe and Humboldt’s Presentation of Nature*, Special Section on Goethe and Idealism, Millán, E. and Smith, J.H. (eds.). *Goethe Yearbook XVIII*, pp. 97-114, 2011.

For the type of explanation based on cause and effect, Goethe substituted a process that can be described only by the untranslatable German word, ‘*Darstellung*,’ which may be defined, approximately, as the demonstration or representation of an object, brought into relation with others in such a way that its significance is revealed.<sup>23</sup>

Arber’s emphasis on the important role that Goethe gives to *Darstellung* as a way to create a *Zusammenhang* or context for understanding elements of nature in relation to one another is well placed. This emphasis on *Darstellung* as a way to allow the relations between objects of nature to emerge is found in Humboldt’s work as well. As Arber observes, “Goethe himself spoke of morphology as a discipline which ‘nur darstellen und nicht erklären will’.”<sup>24</sup> For both Goethe and Humboldt, getting at the unity of nature is essential to presenting nature, for said unity allows the *Zusammenhang* of nature to unfold and the work of *Darstellung* to be accomplished. We can draw a line between what Goethe and Humboldt have in mind with the “unity” of nature and what Schelling had in mind when he made the following claim: “Nature should be visible spirit, spirit should be invisible nature. Hence it is here in the absolute identity of spirit in us and of nature out of us that we must solve the problem of how nature out of us is possible” (*Die Natur soll der sichtbare Geist, der Geist die unsichtbare Natur sein. Hier also in der absolute Identität des Geistes in uns und der Natur außer uns, muß sich das Problem, wie eine Natur außer uns möglich sey, auflösen*).<sup>25</sup> Neither Goethe nor Humboldt is concerned with the question of how nature *outside of us* is possible, for the I is not their reference point. In both Hegel and Schelling, despite important differences in their view of nature, the I and *Geist* are leading concepts, which is not the case for either Goethe or Humboldt. One reason, for example, that Humboldt emphasizes the empirical aspect of coming to an understanding of nature is because he begins with what is there in the world to see, to measure, to experience. Humboldt, however, is not working with an “evacuated concept of nature.,” that is, a concept of nature that needs to be filled with what the human subject can provide.<sup>26</sup> The spirit of nature in Goethe and Humboldt is closer to what W. Heisenberg describes as something similar to the

<sup>23</sup> ARBER, A. *Goethe’s Botany Chronica Botanica*, Vol. 10, No. 2, 1946, p. 85.

<sup>24</sup> *Ibid.*

<sup>25</sup> SCHELLING, F.W.J. *Akademie Ausgabe*. Eds. Bucheim, T., Hennigfeld, J., Jacobs, W.G., Jantzen, J., and Pertz, S. Stuttgart: Frommann-Holzboog, 1976ff., AA Volume I/5, p. 107. For more on understanding the difference between Schelling and Hegel see, PIPPIN, R.B. *Leaving Nature Behind: Or two cheers for “subjectivism.”* In: Smith, Nicholas H. (ed.). *Reading McDowell. On Mind and World*. New York: Routledge, 2002, pp. 58-76.

<sup>26</sup> I take this term from BUBNER., R. *Bildung as Second Nature*. In: Smith, N.H. (ed.). *Reading McDowell. On Mind and World*. New York: Routledge, 2002, p. 209.

molecules of molecular biology: they cannot be seen with our “usual” eyes, but they are not *merely* images of the mind. In the work of Goethe and Humboldt, the spirit of nature emerges from the objects of nature, not, as seems to be the case in Schelling’s work, from the I. Goethe exerted a strong influence on prominent German Idealists of the period, and I do not want to disconnect Goethe and Humboldt from German Idealism *tout court*, but I do think that it is important to note where there are significant differences in the philosophical commitments of Goethe and Humboldt, on the one hand, and thinkers such as Schelling and Hegel, on the other.<sup>27</sup>

In the work of Goethe and Humboldt *Darstellung* is not merely an empirical task, but is always, at least empirical. For Humboldt nature is a realm in which law and freedom blend. Indeed, nature for Humboldt is “the realm of freedom” (*das Reich der Freiheit*).<sup>28</sup>

For Hegel, nature is an “enigma and a problem” the “solution of which seems both to attract and to repel us: it attracts us in that spirit has a presentiment of itself in nature; it repulses us in that nature is an alienation in which spirit does not find itself.”<sup>29</sup> As Angelica Nuzzo puts this, for Hegel, “Nature is Otherness as such in the sense that otherness and externality are the constitutive elements in which nature unfolds its determinations, maintaining the concept as inner ground but constantly betraying it, constantly modifying it through nature’s existing exteriority and through the opposition and contradiction this exteriority poses to it.”<sup>30</sup> Nuzzo goes on to claim that “if nature is Otherness – *Anderssein* and *Andersheit* (Henrich 1982) – it must itself have *its own other and* otherness, in other words, something that is, in turn, other *to it*.”<sup>31</sup>

<sup>27</sup> For more on Goethe’s relation to German Idealism, see *Goethe and German Idealism*, special volume of *Goethe Yearbook*, eds. Elizabeth Millán and John Smith, 2011. For the important connections between *Naturphilosophie* and Kant, see BEISER, F. Kant and *Naturphilosophie*. In: Friedman, M. and Nordman, A. (eds.). **The Kantian Legacy in Nineteenth-Century Science**. Cambridge, MA: MIT Press, 2006, pp. 7-26. For an excellent account of Schelling’s *Naturphilosophie*, see RICHARDS, R. **Science and Philosophy in the Age of Goethe**. Chicago: University of Chicago Press, 2002. See also, STONE, A. **Nature, Ethics, and Gender in German Romanticism and Idealism**. London: Rowman&Littlefield, 2018. Stone provides a detailed and highly original analysis of Hegel and the Romantics on nature. See also, SCHÜLEIN, J.G. The Freedom of Matter: Self-Constitution in Schelling’s ‘Physical Explanation of Idealism’ Schüleín gives an excellent account of Schelling’s attempt to provide “a physical explanation of idealism.” Schüleín presents a compelling and critical account of Schelling’s “effort to secure freedom for ourselves while also finding it in nature” (182). See also, Dieter Sturma, “The Nature of Subjectivity: The Critical and Systematic Function of Schelling’s Philosophy of Nature,” in **The Reception of Kant’s Critical Philosophy: Fichte, Schelling, and Hegel**, ed. by Sally Sedgwick (Cambridge: Cambridge University Press, 2000): pp. 216-231.

<sup>28</sup> *Cosmos*, p. 23/*Kosmos*, p. 4.

<sup>29</sup> HEGEL. **Philosophy of Nature**, p. 194.

<sup>30</sup> NUZZO, A. Nature as the “The Logic of Nature: Nature as the ‘Idea in the Form of Otherness’”. In: Bykova, M. (ed.). **Hegel’s Philosophy of Nature. A Critical Guide**. Cambridge: Cambridge University Press, 2024, p. 114.

<sup>31</sup> *Ibid.*, p. 115.

Nature, for Hegel, is a riddle to us, and Nuzzo pushes a point not considered by Adorno, namely that just as spirit establishes Nature's otherness, "*we humans may very well be an enigma to nature – that we are the 'other to nature'.*"<sup>32</sup> In other words, Nuzzo pushes us to consider that, "[a]s much as our practical and cognitive attitudes to nature constitute the entry point to Hegel's Philosophy of Nature, nature's otherness seems to demand not only the possibility of framing nature's existence independently of them but even to view them as the very "other to nature," namely, as something that nature itself resists and rejects and regards as utterly meaningless."<sup>33</sup> Nuzzo's reading is impressive as it clarifies Hegel's take on nature and pushes that view away from the hubris of the anthropocentric lens with which Hegel operated, showing us that the tools needed to humble spirit can be found in Hegel's view of nature. Illetterati also argues for a view of nature in Hegel that would address Adorno's critique.<sup>34</sup> Illetterati analyzes Hegel's early writings and argues that the view of nature in those early writings finds its fuller articulation in his developed system. Illetterati identifies in Hegel's system a conception of "freedom as rooted in life itself, and in turn, of conceiving of life as a dimension that is neither purely natural nor purely spiritual but the horizon from which something like nature and spirit make sense."<sup>35</sup> This middle position of freedom places Hegel in the company of Humboldt; it would also free Hegel of some of the charge levelled against him by Adorno.

Humboldt's view of nature is humble from the outset, and there is not the alienation of which Hegel speaks as he describes nature; the very alienation at the root of Adorno's complaint. Humboldt speaks of our unity with nature. As indicated above, for Humboldt, nature is the "realm of freedom" (*Reich der Freiheit*), a dynamic realm of constant change, flux, life, of which humans are but one part. There is no theme in either Goethe or Humboldt of "reason recasting itself into nature" – they are more attuned to a presentation of nature that does justice to the findings of empirical science and to the aesthetic responses aroused by the beauties of

<sup>32</sup> Ibid., p. 116.

<sup>33</sup> Ibid., p. 116.

<sup>34</sup> ILLETTERATI, L. Nature and Life in Hegel's Early Writings. In: Corti, L. and Schülein, J.G. (eds.). **Nature and Naturalism in Classical German Philosophy**. New York: Routledge, 2023, pp. 186-208.

<sup>35</sup> Ibid., p. 206. See also, SCHÜLEIN, J.G. Nature's Otherness: On the Status of Nature in Hegel's Encyclopedic System. In: Stein, S. and Wretzel, J. (eds.). **Hegel's Encyclopedic System**. New York: Routledge, 2022, pp. 133-154. Schülein argues that "understanding what exactly [Hegel] means when he speaks of the otherness of nature is crucial for a proper assessment of his philosophical project" (Ibid., p. 133). Schülein emphasizes that for Hegel, "the philosophical consideration of nature must 'be in agreement with our empirical knowledge of Nature'" (Ibid., p. 137). On Schülein's reading, for Hegel, "nature is not only present in the sphere of spirit, it may even resist spirit" (Ibid., p. 154). Hence Schülein pushes against the view that in Hegel's account of Nature, spirit eclipses nature, and nature vanishes.

nature. Hegel approached nature with a different sort of net, one aimed at truth and one which involved the dialectic that had concerned Goethe.

The conversation between Goethe and Hegel that I referenced above on the topic of dialectic also caught Adorno's attention. In his *Aspects of Hegel's Philosophy*, he writes:

In a conversation with Goethe, handed down by Eckermann, in which he was unusually candid, Hegel defined the dialectic as the organized spirit of contradiction. That kind of cunning is not an insubstantial element of the dialectic, a kind of grandiose peasant shrewdness that has learned to submit to the powerful and adapt to their needs until it can wrest their power from them: the dialectic of lordship and bondage lets that secret out. We know that throughout his life Hegel held to the Swabian dialect, even as an ostensible Prussian state philosopher, and reports about him repeatedly note with amazement the surprising simplicity of the character of this man who was so exceptionally difficult as a writer. He remained unfalteringly faithful to his origins, the precondition for a strong ego and any elevation of thought.<sup>36</sup>

Adorno's portrait of Hegel reveals an authentic thinker, one who would not have been "spiritually sick" or ever misled by the dialectic that has vexed and confused many a thinker over the centuries.<sup>37</sup> Recalling Goethe's comments at the tea party with Hegel, Hegel would be well-suited for the study of nature if we follow Adorno's description of him as an authentic being, true to his Swabian roots. Recall that for Goethe, "in nature we are dealing with something which is infinitely and eternally true, and which immediately rejects as inadequate everyone who does not show complete integrity and honesty in the way he observes and treats his subject". Let us now turn to Hegel's dialectic (part of what made Hegel a difficult writer) as a way to focus on his view of the relation between science and nature.

#### 4. *Hegel on Science and Nature*

In the Introduction to the *Phenomenology of Spirit*, Hegel whimsically describes the importance of giving a precise account of the nature and limits of cognition:

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<sup>36</sup> ADORNO. *Hegel: Three Studies*, p. 43.

<sup>37</sup> For more on Hegel's dialectic, see GADAMER, H.G. *Hegel's Dialectic. Five Hermeneutical Studies*. Trans. by R. Christopher Smith. New Haven: Yale University Press, 1971.

Without a more precise definition of [the] nature and limits [of cognition], we might grasp clouds of error instead of the heaven of truth.<sup>38</sup>

The heaven of truth awaits the person who is careful about her method. Hegel's view of science rests on a commitment to truth and a trust in a method that may not always be free of error:

Meanwhile, if the fear of falling into error sets up a mistrust of Science, which in the absence of such scruples gets on with the work itself, and actually cognizes something it is hard to see why we should not turn round and mistrust this very mistrust. Should we not be concerned as to whether this fear of error is not just error itself?<sup>39</sup>

Hegel is aware of the role that error must play in any philosophical inquiry. And his view of science, as he describes it in the *Phenomenology*, points to the importance of searching for truth and not lazily accepting claims based on authority. In staying committed to truth, one remains sincere/authentic in the ways that were emphasized by both Goethe and Adorno:

...the resolve, in Science, [should be] not to give oneself over to the thoughts of others, upon mere authority, but to examine everything for oneself and follow only one's own conviction, or better still, to produce everything oneself, and accept only one's own deed as what is true.<sup>40</sup>

Hegel's embrace of fallibility and openness to error puts his thought in synch with the modern spirit of scientific inquiry and lend evidence to Adorno's characterization of Hegel as a revolutionary thinker, one who provides us with tools to combat the very political forces I mentioned at the outset of this essay. Nonetheless, already in the above cited claim, one detects the line of thinking that will lead to a view of nature that is guided by concepts rather than by the truths of the empirical sciences. As Terry Pinkard puts it: "natural science found its truth in *Naturphilosophie* but *Naturphilosophie* found its truth in *Geistesphilosophie*, the philosophy of

<sup>38</sup> HEGEL, G.W.F. **Phenomenology of Spirit**. Trans. by A.V. Miler. Oxford: Oxford University Press, 1977, p. 46/ "Ohne die genauere Bestimmung seiner Natur [die Natur des Erkennens] und Grenze [werden] Wolken des Irrtums statt des Himmels der Wahrheit erfasst" (HEGEL, G.W.F. **Phänomenologie des Geistes**, Vol. 3, **Werke**. Ed. Moldenhauer, E. and Michel, K.M. Frankfurt am Main: Suhrkamp, 1986, p. 68.

<sup>39</sup> Ibid., p. 47/ "Inzwischen, wenn die Besorgnis, in Irrtum zu geraten, ein Mißtrauen in die Wissenschaft setzt, welche ohne dergleichen Bedenklichkeiten ans Werk selbst geht und wirklich erkennt, so ist nicht abzusehen, warum nicht umgekehrt ein Mißtrauen in dies Mißtrauen gestzt und besorgt werden soll, daß diese Furcht zu irren schon der Irrtum selbst ist (HEGEL. **Phänomenologie des Geistes**, p. 69).

<sup>40</sup> Ibid., p. 50/ "...in der Wissenschaft [hat man den Vorsatz] auf die Autorität sich den Gedanken anderer nicht zu ergeben, sondern alles selbst zu prüfen und nur der eigenen Überzeugung zu folgen oder, besser noch, alles selbst zu produzieren und nur die eigene Tat für das Wahre zu halten (HEGEL. **Phänomenologie des Geistes**, p. 72-73).

mind or spirit.”<sup>41</sup> His authenticity and earnestness notwithstanding, is Hegel a “dialectical sufferer” after all?

Hegel’s dialectic is part of the structure of his idealism, and this idealism, rooted as it is in static forms, is not empirical enough for thinkers who have their gaze focused on life and change. Hegel puts the human subject first when he writes:

*Inasmuch as the new true object issues from it, this dialectical movement which consciousness exercises on itself and which affects both its knowledge and its object, is precisely what is called experience.*<sup>42</sup>

An empirical scientist might not be satisfied with Hegel’s notion of ‘experience.’ A strong critic of Hegel was Karl Popper. In *The Open Society and its Enemies*, Popper shuns Hegel’s totalizing claims as tyrannical and finds a quest for absolute knowledge to be at odds with the open scientific method he endorses.<sup>43</sup> As Donald Verene reminds us, Popper “calls Hegelian dialectics ‘the mystery method’ that is supposed to replace ‘barren formal logic’.”<sup>44</sup> Claims from Hegel like the following rouse Popper’s suspicions, taking us away from the heaven of truth and towards the clouds of error:

The experience of itself which consciousness goes through, can, in accordance with its Notion, comprehend nothing less than the entire system of consciousness, or the entire realm of the truth of Spirit... And finally, when consciousness itself grasps this its own essence, it will signify the nature of absolute knowledge itself.<sup>45</sup>

Hegel’s dialectical method is aimed at capturing “nothing less than the entire system of consciousness” or “the entire realm of the truth of spirit” so that the “nature of absolute

<sup>41</sup> PINKARD. *German Philosophy*, p. 268.

<sup>42</sup> HEGEL. *Phenomenology*, p. 55/“Diese *dialektische* Bewegung, welche das Bewußtsein an ihm selbst, sowohl an seinem Wissen als an seinem Gegenstande ausübt, *insofern ihm der neue wahre Gegenstand* daraus *entspringt*, ist eigentlich dasjenige, was *Erfahrung* genannt wird“ (HEGEL. *Phänomenologie des Geistes*, p. 78).

<sup>43</sup> For more on Popper’s critique of Hegel, see MILLÁN, E., From Hegel’s Dialectical Trappings to Romantic Nets: An Examination of Progress in Philosophy. In: Limnatis, N. (ed.). *Hegel’s Dialectic*. New York: Continuum Press, 2010, pp. 237-251.

<sup>44</sup> VERENE, D.P. Hegel’s Nature. In: Houlgate, S. (ed.). *Hegel and the Philosophy of Nature*. Albany: SUNY Press, 1988, p. 211.

<sup>45</sup> *Ibid.*, pp. 56-57. The German text is: “Die Erfahrung, welche das Bewußtsein über sich macht, kann ihrem Begriffe nach nichts weniger in sich begreifen als das ganze System desselben oder das ganze Reich der Wahrheit des Geistes...und endlich, indem es selbst dies sein Wesen erfäßt, wird es die Natur des absoluten Wissens selbst bezeichnen (PG, pp. 80-81).

knowledge” can be signified. Is it bound to overlook its own fallibility and deal in the infallibility that gives rise to intellectual despotism, resulting in the spiritual sickness of which Goethe and Hegel himself complained.

Hegel views philosophy as a discipline that should aspire to be like a science [*Wissenschaft*] and which is driven by the goals of absolute perfection and completeness: the literary form that Hegel uses is not open or playful (even while it is innovative and at times poetic): it guides the reader via strict argumentation to the conclusions that will authoritatively establish the theses defended. As Walter Kaufmann emphasizes in his article, “The Hegel Myth and Its Method,” for Hegel, “philosophy did not stand between religion and poetry but above both. Philosophy was, according to him, its age comprehended in thought, and – to exaggerate a little – the philosopher’s task was to *comprehend* what the religious person and the poet *feel*.”<sup>46</sup> As Alison Stone emphasizes, “[t]he method of philosophy of nature... is to subject scientific accounts of natural forms to a rational reconstruction.”<sup>47</sup> In my essay, “Hegel and Alexander von Humboldt on Nature,” I posed the question (inspired by Adorno) of whether for Hegel, the structure of the philosophy of nature is determined a priori by self-determining reason or a posteriori by the findings of science.<sup>48</sup> Admittedly, I find in Hegel some residue of a “dialectical sufferer” and find his view of nature limited by the trappings of a penchant for system and for certainty. Marina Bykova argues *against* the aprioristic interpretation of Hegel’s philosophy of nature, and in her essay, “On Hegel’s Account of Nature and Its Philosophical Investigation,” presenting a well-balanced account of Hegel’s philosophy with an accompanying portrait of Hegel as a serious student of nature.<sup>49</sup> Bykova argues that “Hegel not only offers a thoughtfully grounded and compelling view of nature but he also contributes novel insights regarding the course and internal processes of its development.”<sup>50</sup> No matter how much spirit seems to encroach upon the independent reality of Nature in Hegel’s thought, we do well to keep in mind that Hegel was an active member of the mineralogy work in Jena, so someone who, as Bykova

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<sup>46</sup> KAUFMAN, W. The Hegel Myth and Its Method. *The Philosophical Review*, Vol. 60, No. 4, Oct., 1951, pp. 459-486, p. 21.

<sup>47</sup> STONE. *Nature, Ethics, and Gender*, p. 132.

<sup>48</sup> MILLÁN BRUSSLAN, E. *Naturphilosophie* and the Problem of Clean Hands: Hegel and Alexander von Humboldt on Nature. In: Bykova, M. (ed.) *Hegel’s Philosophy of Nature. A Critical Guide*. Cambridge: Cambridge University Press, 2024, pp. 58-75.

<sup>49</sup> BYKOVA, M. On Hegel’s Account of Nature and Its Philosophical Investigation. In: Bykova, M. (ed.) *Hegel’s Philosophy of Nature. A Critical Guide*. Cambridge: Cambridge University Press, 2024, pp. 76-96.

<sup>50</sup> BYKOVA. On Hegel’s Account of Nature, p. 77.

points out, sought to offer “a philosophical assessment of the findings and insights derived from scientific investigations into the natural world.”<sup>51</sup> In his account of Hegel’s view of nature, Collingwood also emphasizes Hegel’s connection to the empirical:

Nature, for Hegel, is real; it is in no sense an illusion, or something which we think to exist when what really exists is something else; nor is it in any sense a mere appearance, something which only exists because we think it. It really exists, and exists independently of any mind whatsoever.<sup>52</sup>

Debates continue over the status of nature in Hegel’s thought, and the recent work on this subject demonstrates that it remains a rich field to explore.

### 5. *Concluding Remarks*

What the botanist Agnes Arber said of Goethe, namely that “he was a great biologist who, in the long run, overstepped the bounds of science,”<sup>53</sup> is also true of Humboldt and of Hegel. As Verene reminds us in “Hegel’s Nature” – “In the *Phenomenology of Spirit* of 1807, Hegel identifies himself in the middle of the title page as “Dr. and Professor of Philosophy at Jena, assessor in the Ducal Mineralogical Society and member of other learned societies.”<sup>54</sup> Verene reminds us, “Hegel, the first phenomenologist, is also the practicing mineralogist.”<sup>55</sup> Even as Hegel spoke of nature as the idea freely set forth, Hegel never denies the reality of nature nor does he move away from investigating the empirical dimensions of nature: he saw himself as a geologist or as Verene puts it, a “rock hound.”<sup>56</sup> Both Hegel and Humboldt were influenced by Goethe, in particular by his interest in a living presentation of nature’s unfolding and his use of the empirical sciences to reveal an art of life unfolding. Humboldt successfully overstepped the bounds of empirical sciences to reach a richer field from which to contemplate nature; the art of science prepared him to overstep the limits of the empirical sciences. Hegel’s sincere interest in the truths of the natural world were sometimes overcome by the structures of his system of thought, yet he never abandoned his commitment to the empirical sciences. With

<sup>51</sup> BYKOVA. On Hegel’s Account of Nature, p. 79. Cf. Pippin 2002, pp. 60ff.

<sup>52</sup> COLLINGWOOD, R.G. **The Idea of Nature**. Oxford: Oxford University Press, 1945.

<sup>53</sup> Arber, *op. cit.*, p. 86. Arber’s claim recognizes that Goethe was, in the first place, a scientist, something still open to debate.

<sup>54</sup> VERENE, Hegel’s Nature, p. 209,

<sup>55</sup> *Ibid.*

<sup>56</sup> *Ibid.*

the innovative work of Goethe, Hegel, and Humboldt on the question of nature, we moved from vicious empiricism to a tender empiricism which lent art to science and allowed a fuller portrait of nature to emerge.

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