HOW SHOULD NATURE BE STUDIED PHILOSOPHICALLY? A HEGELIAN RESPONSE

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This paper addresses the question of how nature should be philosophically studied within a Hegelian framework. The focus is epistemological: it examines the relationship between philosophy and the empirical sciences in the constitution of natural categories. I argue that this relationship is neither strictly a priori nor strictly a posteriori but unfolds through a speculative interplay between an a priori philosophical principle of unity and an a posteriori attentiveness to empirical discovery. To support this view, I engage with prominent positions in the secondary literature – namely, Alison Stone's strong a priorism and John Burbidge's a posteriorism. After addressing two key problems in these interpretations, I show how both mistakenly attempt to read Hegel's Philosophy of Nature *through the rigid Kantian dichotomy of a priori and a posteriori, which speculative thought seeks to overcome. Drawing on the work of Brigitte Falkenburg, Cinzia Ferrini, and Sebastian Rand, I propose that natural categories should be understood as the result of empirical content that is reorganized, a posteriori, in accordance with an a priori principle of systematic unity. This interpretation not only aligns with Hegel's own texts but also highlights the dynamic and active character of his philosophy.*

Keywords: *Hegel – Philosophy of Nature – A priori/a posteriori – empirical sciences – classical German philosophy*

Este artículo aborda la cuestión de cómo debe estudiarse filosóficamente la naturaleza dentro de un marco hegeliano. El enfoque es epistemológico: se examina la relación entre la filosofía y las ciencias empíricas en la constitución de las categorías naturales. Sostengo que esta relación no es estrictamente a priori ni estrictamente a posteriori, sino que se despliega a través de una interacción especulativa entre un principio filosófico de unidad a priori y una atención a posteriori al descubrimiento empírico. Para defender esta postura, dialogo con posiciones destacadas en la literatura secundaria —en particular, el apriorismo fuerte de Alison Stone y el posteriorismo de John Burbidge. Tras abordar dos problemas clave en estas interpretaciones, muestro cómo

ambas intentan erróneamente leer la Filosofía de la Naturaleza *de Hegel a través de la rígida dicotomía kantiana entre lo a priori y lo a posteriori, dicotomía que el pensamiento especulativo busca superar. Basándome en los trabajos de Brigitte Falkenburg, Cinzia Ferrini y Sebastian Rand, propongo que las categorías naturales deben entenderse como el resultado de un contenido empírico que es reorganizado, a posteriori, de acuerdo con un principio a priori de unidad sistemática. Esta interpretación no solo se alinea con los propios textos de Hegel, sino que también resalta el carácter dinámico y activo de su filosofía.*

Palabras clave: *Hegel – Filosofía de la Naturaleza – A priori / A posteriori – ciencias empíricas – filosofía clásica alemana*

In recent years, Hegel's *Philosophy of Nature* has seen a notable revival. This renewed attention is largely driven by the work of contemporary Hegelian scholars such as Cinzia Ferrini, Wes Furlotte, Luca Illetterati, Karen Koch, Edgar Maraguat, Raoni Padui, Terry Pinkard, Sebastian Rand, and Alison Stone, among others.[1] What seems to underlie this renewed interest is a growing shift within Hegel scholarship away from the idea that Hegel must be understood as a rigid thinker. While the rational core of Hegelian thought is still acknowledged, scholars are increasingly turning their focus to the parts of the system that are more problematic or even unsalvageable—above all, the *Philosophy of Nature*. In continuity to this new general tendency, the present article proposes a reconsideration of Hegelian thought which does not neglect the *Philosophy of Nature* but rather considers its integral place in the systematic venture, since, as Wes Furlotte underlines, it is impossible to deny that "Hegel himself saw his philosophy of nature as a fundamental dimension of his final system" (Furlotte, 2018, pp.4-5).

This paper sets out to answer, in a Hegelian manner, the question: How should nature be studied philosophically? The aim is therefore primarily epistemological, focusing on the relationship between philosophy and empirical sciences. The central claim is that this relationship is neither strictly *a priori* nor strictly *a posteriori*. Rather, natural categories arise from a speculative collaboration between a logical *a priori* principle of unity and an *a posteriori* attentiveness to scientific discoveries. To support this position, I will engage with both recent and older debates surrounding Hegel's *Philosophy of Nature*, thus aiming also to provide an overall framework of the debate concerning the epistemological problem of this systematic sphere.

The paper is divided into the following sections. In the first, I analyze two opposing positions in the epistemological debate on Hegel's *Philosophy of Nature*: Alison Stone's strong a priorism and John Burbidge's a posteriorism. In the second section, I examine the central problems of each: while strong a priorism fails to give equal weight to philosophy and empirical sciences, I will argue that a posteriorism approaches are unable to account for the local contingency of nature, collapsing back into the rigid *a priori* conception that sees contingency as logically necessary. The third section addresses the deeper problem

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1 Ferrini, 2002, 2009, 2012; Furlotte, 2018; Illetterati, 2014, 2020, 2023; Koch, 2023, 2024; Maraguat, 2020, 2023; Padui, 2010, 2013; Pinkard, 2012; Rand, 2007, 2015, 2017; Stone, 2005, 2018. A general interest in the question of nature in Hegel, and more broadly in classical German philosophy, is evidenced by the volumes: Corti, Schülein, 2023a, 2023b; Bykova 2024. This is a very recent interest. In fact, as Sebastian Rand emphasized in 2007: "There can be no doubt that interest in Hegel among Anglo-American philosophers is greater now than it has been at any point in the past 100 years. This interest has happily taken the form of increased attention to his major published works, primarily the *Phenomenology of Spirit* and the *Philosophy of Right*. (...) But amidst all this increased interest in Hegel, a major part of his mature system has been almost completely ignored: the *Philosophy of Nature*" (Rand, 2007, pp.379–80). Nonetheless, it should not be forgotten that already before this recent attempt to approach Hegel's *Philosophy of Nature*, there were other scholars who had taken it seriously. To mention a few volumes and books that deal directly with this topic: Burbidge, 1996, 2007; Cohen, Wartofsky, 1984; Findlay, 1993 (1958); Houlgate, 1998; Petry, 2002 (1970), 1987, 1993.

of reading Hegel's *Philosophy of Nature* through the still rigid Kantian dichotomy of *a priori* and *a posteriori*—a distinction that Hegel sought to overcome through speculative thought. Here, I side with those interpreters who, in my view, recognize the reciprocal relationship between *a priori* and *a posteriori* in Hegel's *Philosophy of Nature*. In my interpretation, natural categories should ultimately be understood as neither strictly derived logically *a priori* nor as fully independent from a systematic logical principle. Following especially the proposals of Brigitte Falkenburg, Cinzia Ferrini, and Sebastian Rand, I argue that these categories should be seen as *both a priori* and *a posteriori*: they are the result of the scientific laws and categories which are reconsidered and reorganized, *a posteriori*, according to the *a priori* principle of systematic unity. The paper concludes in two steps: first, by supporting my position with textual evidence from Hegel's writings on the relation between philosophy and empirical sciences; and second, by showing how this position helps to overcome the respective limitations of both strong a priorism and a posteriorism. Finally, I will also show how my interpretation permits to consider the Hegelian one a dynamic and complex philosophy.

A posteriori and *A priori* Positions

There is a heated debate surrounding the question as to how the *Science of Logic* and its categories should be understood to relate to the successive part of Hegel's system, the *Philosophy of Nature*. In my view, this can be read not just as an ontological problem, but also as an epistemological question concerning the natural categories and the best way to study nature philosophically. In this sense, this is a debate that has consequences for how we understand the relation between philosophy – understood as the study of the necessary development of the concept – and empirical sciences – understood as the empirical study of the natural world. Stephen Houlgate underlines this epistemological problem regarding the relationship between philosophy and empirical sciences in the study of nature, referring to the two most extreme positions in this debate – which will be considered in this section of the paper:

> It should be noted, however, that there is by no means universal agreement amongst Hegel scholars on the precise nature of the relation between philosophy and natural science in Hegel's *Philosophy of Nature*. Some argue that the structure or skeleton of the *Philosophy of Nature* is developed purely conceptually, but that the flesh, as it were, is derived from empirical observation and scientific experimentation and analysis. (…) Discoveries in science are thus understood and evaluated in the light of a conceptual account of nature which is developed *a priori*. Others argue, however, that scientific discoveries themselves condition, and perhaps even determine, the development of Hegel's conceptual account of nature. On this view, the procedure of Hegel's philosophy is not to map natural phenomena on to an *a priori* conceptual structure, but to provide a flexible conceptual framework which organizes in an intelligible way, and

> is wholly *relative* to, the scientific knowledge of a given time, and which changes with future scientific discoveries (Houlgate, 1998, pp.xiii, xiv)

The breadth of the debate with numerous different positions is testimony to the difficulty and obscurity of these passages in Hegel. Unfortunately, there is no textual evidence proving any one interpretation, since there are many passages on the subject that lend themselves to opposing readings.[2] To show this uncertainty, it is enough to refer to the following passage, in which Hegel on the one hand stresses the importance of a link between empirical sciences and philosophy – the philosopher indeed considers them similar, since science is also "a *theoretical*, and indeed a *thinking* consideration of Nature" (Hegel, 2004, p.6, §246) – and then affirms their fundamental difference precisely in relation to the empirical foundation:

> The relation of philosophy to the empirical sciences was discussed in the general introduction [to the *Encyclopaedia*]. Not only must philosophy be in agreement with our empirical knowledge of Nature, but the origin and formation of the Philosophy of Nature presupposes and is conditioned by empirical physics. However, the course of a science's origin and the preliminaries of its construction are one thing, while the science itself is another. In the latter, the former can no longer appear as the foundation of the science; here, the foundation must be the necessity of the Notion (Hegel, 2004, p.6, §246R)

Taking this passage alone we can discern the basis for the two principal – and radically opposite – interpretations that stand out in the contemporary debate on this topic. The first one is what Alison Stone calls "a posteriorism", whose main representative is John Burbidge in *Real Process: How Logic and Chemistry Combine in Hegel's Philosophy of Nature* (1996).[3] To analyze Burbidge's position, I will principally address to his book *Hegel's Systematic*

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2 For a detailed analysis of the textual ambiguities in the *Philosophy of Nature*, see Stone, 2005, pp.2-9. J.N. Findlay also writes: "Hegel gives no wholly clear account of the precise relation between his rational physics and the flourishing empirical sciences on which it obviously depends. At times he holds that we must take the concepts hammered out in the empirical sciences, and transform them in the 'quietude of thought': more commonly he holds that we must first frame notions of the abstract 'other' of the Idea, and *then* look for empirical cases which more or less illustrate them" (Findlay, 1993, p.270).

3 In this sense, I draw on Alison Stone's reading, which highlights the distinctive character of Burbidge's position: "I have expounded Burbidge's reading of Hegel at length to see whether his work can be considered to recast weak a priorism in a tenable form. As I have explained, previous scholars—notably Petry and Buchdahl—have plausibly argued that a tenable version of the weak a priori method must investigate not which scientifically described forms are rationally necessary, but how far scientific accounts can be reorganized or reinterpreted in light of a priori logical categories. Yet Burbidge's arguments show that this reconstructive method can only accommodate the contingency and diversity of empirical findings by organizing them not through a priori logical categories but through a distinct set of "natural" categories that are a posteriori. In this way, the interpretive effort to reformulate weak a priorism has transformed it into a significantly different method, which can be called 'a posteriorism'"(Stone, 2005, p.19).

Contingency (2007). The second position in this debate is what can be defined a "strong a priorism", whose main supporter was, initially, Alison Stone in *Petrified Intelligence* (2005). These two positions – far from exhausting the debate on the relation between philosophy and science but rather representing its extreme limits – are in opposition with one another.[4]

On the one hand, Burbidge's work has focused on the analysis of the role played by contingency in the Hegelian system, taking as its starting point the *Science of Logic*, in which Hegel concludes that "contingency is absolutely necessary – that unique individuals are not simply subordinated to overarching uniformity" (Burbidge, 2007, p.16). If contingency proves to be necessary, then we must try to understand the role played by it when we approach a natural and social world of which we want to gain knowledge and for which general logical laws do not seem to be exhaustive. To solve the question concerning the presence of the contingent in the world, Burbidge takes up the following categories: "firstness", understood as the immediacy of a universal law; "secondness", understood as the "brute facts" (Burbidge, 2007, p.50) of our experience; and "thirdness", understood as the mediation between the first two. The moment of secondness recalls, therefore, the contingency of the brute facts, which are characterized by the element of unpredictability, by the fact that they might not be as we expect them to be.

When we try to find philosophical explanations of the world, we find ourselves faced with an essential problem: experience does not always correspond to our certain beliefs, on the contrary, being contingent and unexpected it can show how our certainties do not in fact correspond to the truth. In this way Burbidge links the necessity of the contingency declared by Hegel in the *Science of Logic* to the *Phenomenology of the Spirit*, whose purpose lies in demonstrating how true knowledge needs to face the negative power of secondness. How, then, does true knowledge take place? For Burbidge the answer lies in the concept of necessity understood speculatively, that is, in the way in which, through thirdness, we find a mediation between absolute and universal thought and the contingencies of the world. The

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4 There are positions in between the two opposing ones that I am considering here, which will be touched on in the following sections. For the moment, it is necessary to highlight four innovative positions. First, the position of Edward Halper, for who the natural categories are not new logical categories, but the result of two logical categories, the absolute idea and being. In this way, "the conceptual development that constitutes the content of the absolute idea along with the simple immediate (category of) being that constitutes its form comprise together a 'totality' that defines the realm of nature" (Halper, 1998, p.33). Second, the position supported by Stephen Houlgate, for whom there is a distinctive logic of nature, which "is ultimately derived from the purely logical Idea, since the Idea determines itself to be nature; but it follows a course of its own that is generated by the natural-logical structure of externality" (Houlgate, 2002, p.118). See also Houlgate, 2024, p.181). Third, the position of Terry Pinkard, for whom the a priori does not stop at logical categories, but the basic objects of nature themselves "are to be established by developing them out of the concept of what is external to (logical) thought" (Pinkard, 2024, p.264). Fourth, the position of William Maker, who, sustaining the necessity of a common work of philosophy and empirical sciences, affirms that "Hegel articulates a philosophy of nature which avoids metaphysical idealism and which provides an a priori account of nature, not as it is given in all its specificity (as that must fall beyond systematic thought), but in terms of delineating and accounting for the general features of givenness as such" (Maker, 1998, pp.19-20).

latter relativize the claim of absoluteness of the former, which becomes part of a new claim, capable of containing the mediation between firstness and secondness:

> Secondness or contingency is critical, then, at two stages. Initially it indicates the brute experiences that dialectically frustrate absolute claims to knowledge. But more critically, that frustration must be taken seriously as both conditioning that original claim and being conditioned by it. We need to investigate that mutual dependence if we are to understand how and why qualitatively new claims to absolute knowing emerge (Burbidge, 2007, p.54)

This general focus on the problem of contingency brings attention to that systematic part of Hegel's philosophy where unpredictability seems to have a dominant character, namely the *Philosophy of Nature*. I will therefore try to make the following connection: the natural categories, for Burbidge, are that "thirdness" which is the result of the joint work between "firstness" – i.e. the categories developed in the *Science of Logic* – and "secondness" – i.e. the brute facts of nature, to which empirical sciences try to give order. In this way, the categories of nature cannot be derived *a priori* from the *Science of Logic* and are not even a simple reformulation of them. Rather, they are a result which is dependent on the logical categories but equally distinct from them, thus giving birth to a new set of categories:

> In the first place, the *Philosophy of Nature* is not simply an extension of the *Logic.* (…) When (…) Hegel appeals to the results of science, there are no derivations of these instantiations logically. They are simply introduced, and discussed in his lectures, as they have been presented by scientists. The logic of itself cannot justify the introduction of the references to water or air, to galvanism or combustion, nor even to the fact that separation relies on the various processes of combination and is not itself a distinct process. We discover in nature phenomena that fit the conceptual pattern we have in mind. The final section incorporates the results of this observation of nature into a new conceptual framework.
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> Yet on the other hand, the philosophy of nature does not simply describe nature in its diversity. General patterns of natural phenomena are introduced as instances of a structure that thought has previously articulated; and in the end thought reflects on the total picture and incorporates both the original general considerations and the specific results of experimental evidence into a new conceptual pattern, significantly different from what appeared in the logic, but which can set the systematic stage for the next section (Burbidge, 2007, p.116)[5]

5 See also: "In other words, for all the value of the logical analysis in providing ways of characterizing chemical phenomena, there is no one-to-one correlation. Experience alone can show what phenomena actually occur, and logic does its

On the other hand, we have Stone's form of strong a priorism, which can be summarized as follows: nature and its essential forms can simply be derived *a priori* from logical thinking. Thought – through its developmental activity in which it thinks itself – is determined by logical categories derived from one another, and they are nothing more than the same basic categories of nature. Philosophy therefore already develops *a priori* the categories that characterize nature. As a result, the relationship between philosophy and empirical sciences is articulated according to a dynamic in which the philosopher must find in the empirical laws those that best fit the philosophical category of reference already developed *a priori*:

> Having by a priori reasoning constructed a skeletal vision of nature, the philosopher subsequently asks whether any of the forms independently identified by empirical scientist "correspond to" (*entsprechen*) the forms whose existence she has ascertained rationally. (...) Only if an empirical account "accords" or "corresponds" with some element in Hegel's preconstituted a priori theory of nature does that empirical account get incorporated (Stone, 2005, p.5)[6]

To defend her position, Stone had to first respond to three critiques. The first criticism of this interpretation can be made considering many passages in which Hegel stresses philosophy's appreciation of empirical sciences. In fact, one could assume that the attention shown by Hegel towards the scientific discoveries of his time, to which he dedicates copious sections of the Philosophy of Nature, contradicts the idea of a construction of natural categories completely a priori.[7] As Stone points out, however, the strong a priorism does not imply an

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best to sort that confusion of data into a coherent framework" (Burbidge, 1996, p.164); "The two disciplines, however, differ in the intermediate stage. In the logic, dialectic passes over to an antithesis or contrary in the very process of understanding its initial concept. In the philosophy of nature, in contrast, thought 'declares itself redundant', looks to see what in nature corresponds with its analysed starting-point and then incorporates the results of these observations into its final reflections. On my reading of the philosophy of nature, then, new experimental evidence would introduce complications into the systematic story" (Burbidge, 2006, p.182).

6 The same position is shared by Manfred Gies and Dietrich von Engelhardt: "Die Eigennotwendigkeit der Begriffsentwicklung kann sich dann nicht mehr um die bloße Erfahrung scheren, allerdings (...) müssen die verschiedenen stufen in der Entwicklung des Begriffs ihre Entsprechungen in der Empirie haben bzw. In den Begriffsbildungen der empirischen Wissenschaften. Allerdings: wenn diese Entsprechungen nicht zu finden sind, dann, so Hegel, ist dies ein Mangel der Empirie, nicht der Naturphilsophie" (Gies, 1987, p.77); "Stets wird der rahmen der empirischen Naturforschung überstiegen, werden metaphysische Ableitungen entwickelt oder verworfen, die sich in der Naturforschung nicht gewinnen oder nicht bestätigen lassen. Sas Verhältnis der Naturphilosophie zur Naturwissenschaft ist so grundsätzlich kompensierend-kritisch; Hallers Vorstellungen über Sensibilität und Irritabilität erscheinen bei aller empirischen Plausibilität als philosophisch noch unzulänglich (...). Naturphilosophie besitzt eine transempirischen Unabhängigkeit auch einen beispielhaften Zug; empirische Irrtümer müssen deshalb nicht ohne weiteres schon die Naturphilosophie insgesamt infragestellen" (von Engelhardt, 1987, pp.424-425).

7 This is the kind of criticism moved, for example, by Ernan McMullin, who defines the philosophy of nature characterized by this *a priori* approach as a 'first order' philosophy of nature (PN1), "because the warrant on which it rests purports to be a

ignorance of scientific discoveries. On the contrary, the philosopher, in the application of a priori structures, must always pay attention to scientific progress, to find those laws that can best fill the category of thought corresponding to them. It follows that "the extensive presence of scientific findings in the Philosophy of Nature is quite compatible with strong a priorism" (Stone, 2005, p.8).

The second kind of criticism accuses strong a priorism of trying to deduce purely *a priori* the existence of those same forms that scientists have already empirically found. According to this criticism, the work of the philosopher who wants to find the natural categories *a priori*, can therefore be valid only from a theoretical point of view; from a practical-applicative point of view, the philosopher cannot start the philosophical development of the natural categories without taking the same scientific discoveries as the starting point of her philosophical deduction.[8] Stone responds to this kind of criticism by supporting the *a priori* character of natural categories, referring in particular to the Hegelian discussion about light. Stone in fact refers to a Hegelian passage in which there is no doubt that "Hegel designated himself a strong a priori thinker, stating unusually clearly that he is first deducing a certain natural form and then subsequently equating it with empirically described light" (Stone, 2005, p.10). Hegel therefore seems to make a clear distinction between philosophical and scientific work. First, philosophical work emerges as a research founded *a priori*, which follows the necessary development of the concept. Second, the philosopher searches in the discoveries of sciences those empirical manifestations that contain the necessary properties demonstrated *a priori* by philosophical reflection.

These reflections may be sufficient to save the *a priori* procedure from the two criticisms outlined above. However, a third issue remains to be addressed. The problem consists in the fact that this correspondence between logical category and natural laws could lead to an absolutization of scientific discoveries, which are, precisely because of their empirical nature, contingent and always subject to revisions and modifications. Stone is concerned about the possible criticism that finding a correspondence between the necessary logical development of the concept and the scientific laws could absolutize those same scientific laws. This would lead to a decidedly negative view of philosophical work, which would be highly limited and limiting, as it would be incapable of accounting for the obvious and universally accepted non-absolute structure of the sciences, which find numerous modifications

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'philosophic' one distinct from, and prior to, that of science" (McMullin, 1969, p.33). This approach "would provide an understanding of nature prior to, and thus to some extent, at least, unaffected by, developments in science" (McMullin 1969, p.35).

8 This is a critique moved by J.N. Findlay: "Thus the abstract notion of *Ausserisichseyn*, of *partes extra partes*, finds its empirical illustration in our intuition of space, just as the equally abstract notion of an identity pervading differents finds an empirical illustration in the magnet. If we turn, however, to Hegel's practice, it seems plain that his notions have all been framed and moulded so as to cover empirical phenomena, that he has been trying to find ways to talk in Hegelian fashion about phenomenal features such as cohesion, light, magnetism, colour, digestion, procreation, etc., rather than to *find* phenomenal features which correspond to ideas independently arrived at" (Findlay, 1993, p.270).

and alterations during scientific and technological progress. However, a clear account of the character of this correspondence between conceptual structures and empirical discoveries shows this criticism to be invalid. This is because the search for a correspondence between categories developed *a priori* by thought and empirical discoveries in no way implies an absolutization of the latter. In fact, the necessity of the content is present, in this interpretation, only at the moment of the development, by philosophy, of the necessary categories of thought: beyond this moment – beyond the research that operates purely *a priori* in the field of abstract thought – one can no longer speak of necessity. Here lies the difference between philosophical science and empirical sciences, which, unlike the former, cannot be based purely on the necessity of the concept, but take the (contingency of the) empirical world as their starting point. Scientific discoveries cannot, therefore, be totally based on a logic of necessity, and, even if empirical sciences play a role in the structure of the *Philosophy of Nature* – they must correspond to logical categories – they do not play a determinative role in the philosophical construction of natural categories.

Two Problems with A posteriorism and Strong A priorism

Before presenting my view of the relationship between philosophy and empirical sciences in Hegel, I shall first demonstrate why the positions of Burbidge and Stone are, from my point of view, untenable. This is before considering the misattribution of the *a priori* and *a posteriori* terminology in Hegel, which will be the subject of the next section. First, Burbidge's reading appears problematic insofar as it seems to imply that Hegel has in fact already justified the existence of natural contingencies *a priori*. Indeed, one could say that Burbidge himself seems to go against his *a posteriori* reading: Hegelian logic seems to have already anticipated the existence of the contingency of the world, in particular the natural one, and totally *a priori*, without any reference to experience. Of course, anticipating the existence of contingency does not equate to specifying how this contingency will manifest itself, but in any case, there is a serious risk of falling back into that form of a priorism in which the natural elements simply fill in logical categories already developed *a priori* – in this case, the category of contingency.

This problem becomes clear if we consider a point raised by Raoni Padui, who argues, in the article *The Necessity of Contingency and the Powerlessness of Nature: Hegel's Two Senses of Contingency* (2010), that it is essential to outline two different characterizations of contingency in Hegel. The first sense of contingency has to do with the category analyzed in the *Science of Logic*, where it is understood as dependence and conditionality. The second sense of contingency is instead the one present in the *Philosophy of Nature*: it expresses that character of unpredictability characteristic of natural phenomena. Seeing the contingency of nature as unpredictable seems to link this contingency to one of the senses of contingency encountered in the logical category of formal possibility, i.e. contingency as lack of a 'why'. But in the absolute necessity of the *Science of Logic*, this

contingency understood as the lack of a 'why' is accepted from a universal perspective: the set of existing conditions represents an absolute which, in its unconditionality, cannot be justified by anything else. In nature, instead, we find what Padui calls a local and pre-categorical sense of contingency. The contingency, understood as the lack of a 'why' in a particular and relative sense, has not been proven in the *Science of Logic*. That of nature is therefore a sense of unpredictability and contingency in a 'pure' sense:

> While Hegel may not admit of this language, it appears that there are two different types of limits for philosophy corresponding to these two senses of contingency, one set by reason itself in determining its own limits, and one set by nature's irrationality thereby limiting Reason's comprehension of natural products. Reason cannot ground the irrational in nature without undermining precisely what makes it truly irrational. So, while Hegel does *include* the category of contingency within Reason, he also must *exclude* the radical contingency of real natural objects from rational comprehension (Padui, 2010, p.250)

The problem raised by Padui is the fact that some authors have derived the justification of the existence of contingency in the natural world through logical argumentation, without making any distinction between the two senses of contingency. Paradoxically, this would in fact lead Burbidge's position to collapse back into a priorism.[9]

On the other hand, while Stone's position of strong a priorism has managed to withstand criticism, a fundamental issue remains concerning the relationship between philosophy and empirical sciences, which appears unbalanced and unsatisfactory. In response to the first criticism, Stone emphasizes how strong a priorism is not characterized by a denial of scientific discoveries, but rather by close attention to them, since it is necessary to find, in the course of scientific progress, the physical phenomenon that best corresponds to a certain conceptual category. The problem with this interpretation is that, although it recognizes some kind of value in the empirical sciences, it does not grant them equal status in relation to philosophy. Rather, it is a relation in which, clearly, philosophy dictates the rules of the game, by establishing absolute logical and natural categories: all that science can do is to try to adapt to these, making its laws fall into these fixed and absolute structures. In Stone's proposal, therefore, one cannot unfortunately find an active role on

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9 The problem of these readings is accurately underlined by Padui: "By identifying the logical reconstruction of the category of contingency with claims about "reality generating its own irrationality" and "contingent things in the world," these commentators have simply played into the hands of those who see Hegel deducing the contingent objects of nature from Reason alone. If Hegel does not fall prey to eliding the logical category of contingency with actual manifestations of contingency in nature, then there must be two senses of contingency operative in Hegel's philosophy. The second meaning of contingency would actually be incompatible with the first and suggest that contingency in nature is not the *category* of contingency, but a *pre-categorical* sense of contingency" (Padui, 2010, p.249).

the part of the empirical sciences: certainly, the space for change and the claim of non-absolutization of scientific theories is guaranteed by Stone's project, but this is not enough to guarantee a reciprocal – we could say, dialectical – relationship between philosophy and empirical sciences.

Moreover, Stone's interpretation runs the risk of applying an anti-Hegelian division between form and matter, considering empirical discoveries as a content to fill a pre-given logical form. Also, her position considers the sciences as mere empirical studies, while it is clear that they are studies that involve a large theoretical part of conceptual consideration – something that Hegel himself argues. So, the risk is that "(i)t is the dialectic of Hegelian philosophy which takes over the scene, and the physical sciences which it reduces to mere empiricism are accorded very short shrift" (Wahsner, 1993, p.86). In other words, in the relation between philosophy and sciences, these are limited and subordinate to the work of the former.[10]

A Speculative Relation between *A priori* and *A posteriori*

In the articles *The Importance and Relevance of Hegel's "Philosophy of Nature"* (2007) and *Hegel's Philosophy of Nature* (2017), Sebastian Rand holds that "Hegel rejects all versions of the a priori/a posteriori distinction" (Rand, 2007, p.385).[11] Following his argumentation, I want to sustain that there is a fundamental problem regarding both Stone's and Burbidge's readings regarding the Hegelian treatment of the categories of *a priori* and a *posteriori*. In fact, both readings seem to be linked to a pre-Hegelian, Kantian consideration of these categories. In Kant, indeed, we find a clear distinction between *a priori* and *a posteriori,* as the author clearly states in the *Critique of Pure Reason*:

> It is therefore at least a question which requiring closer investigation, and one not to be dismissed at first glance, whether there is any such cognition independent of all experience and even of all impressions of the senses. One calls cognitions *a priori*, and distinguishes them from empirical ones, which have their sources *a posteriori*, namely in experience (Kant, 2000, p.136)

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10 For another statement of this problem, see Jürgen Habermas: "When philosophy asserts itself as authentic science, the relation of philosophy and sciences completely disappears from discussion. It is with Hegel that a fatal misunderstanding arises: the idea that the claim asserted by philosophical reason against the abstract thought of mere understanding is equivalent to the usurpation of the legitimacy of independent sciences by a philosophy claiming to retain its position as universal scientific knowledge" (Habermas, 1972, p.24).

11 "The evidence thus suggests that Hegel is not much interested in appealing to this distinction to characterize any of his own claims—either as a priori or a posteriori. If we want to understand the relation Hegel articulates between the natural sciences and his own philosophy of nature, then, we do well to put the a priori/a posteriori distinction aside and draw instead on other resources. Such resources are readily available; they offer both a Hegelian picture of the character of natural-scientific representations and the elements of a method for transforming these representations into properly systematic Hegelian concepts" (Rand, 2017, p.389).

Uncritically applying this Kantian distinction to Hegelian philosophy can be misleading and may be incorrect, since Hegel's position goes beyond a straightforward dualism and moves towards a speculative reconsideration of the terms *a priori* and *a posteriori*. Indeed, in Hegel the fundamental point consists in overcoming any dualistic opposition in the name of the speculative union of the two terms. This unity can be summarized by the notion of union-in-difference: in this structure, both terms maintain their own identity, but the identity of each is shown to be dependent on its essential inseparability from the other term of the couple. In other words, each term cannot be understood as a simple immediacy but as immediacy mediated by the relationship with the other. The use of the term union-in-difference serves here to underline that in Hegel the overcoming of the dualistic opposition between two terms does not imply abandoning the use of the terms themselves. The overcoming that Hegel achieves with the speculative union is therefore not an overcoming in the use of terms, but an overcoming of their rigid opposition. In this sense, the terms *a priori* and *a posteriori* can still be used, but with an awareness of their intrinsic relationality.

We must therefore try to analyze what it means to understand *a priori* and *a posteriori* according to this speculative union. According to Sebastian Rand, to do this, philosophy must be understood as *Nachdenken*, that is, as that thought which reflects on scientific laws, in order to take them and reorganize them according to a systematic conformation. The work of philosophy, therefore, consists in taking these scientific universals – which for Hegel, although rational, are still abstract universals, not connected among them in a systematic way – and organizing them according to an organic and systematic form. Philosophical thought therefore allows us to approach the realm of the natural through a different form. Indeed, the natural world, grasped through scientific laws and their universal abstracts, is not yet understood in a concrete way. If instead it is thought through philosophical thought, we can 'purify' it and observe it through the lens of the universal necessity of reason:

> Hegel's method aims to give the sciences a form of generality that does not exhibit the shortcomings of abstraction, by transforming the "unconceptualized concept" of the understanding into an explicitly "conceptualized" one of reason (…). As a "*conceptualizing* consideration" of nature, the philosophy of nature deals with "the same *universals*" produced by natural science, "but *for themselves*" (…); by means of a synthetically oriented thinking-through or *Nachdenken*, rather than an abstractive *Reflektion*, it "translates the universals delivered to it … into the concept" (Rand 2017: 391)

Philosophy, therefore, appears to be open to change, progress and scientific discoveries, since its task is not to determine *a priori* the unfolding of nature, but to organize the universals of the natural sciences (and so, to operate *a posteriori*) according to a systematic *a priori* principle. In this sense, as Cinzia Ferrini states, the task of the Idea is to arrive afterwards in a chronological

sense, in order to systematically organize natural laws. This means that, although the Idea has logical priority over the external world, it does not organize nature *a priori*:

> It is worth noting, indeed, that *philosophical knowing* "starts" from the condition (*Bedingung*) of a content that does not belong to thought, but which has been already processed by the theoretical consideration of the sciences and handed on to the conceptual one of philosophy. The latter has the task to ground necessity of what actually is: the Idea is not the first in time, but philosophically-scientifically speaking (...) it "becomes" the first, from the last (Ferrini, 2002, pp-80-81)[12]

This perspective can be traced back to the position that Stone embraces in *Nature, Ethics and Gender in German Romanticism and Idealism* (2018). Stone claims that Hegel achieves a rational reconstruction of nature in the following way: we must start with the scientific laws themselves and then organize and systematize these retroactively with philosophical thought. Philosophy gives scientific laws a necessary order, in which they gain a rational relation to each other. In this way nature is organized according to a system of degrees, in which each degree resolves the tensions and contradictions present in the previous one:

> Nature thus exhibits a progression in that each of its forms resolves tensions within other forms, the most advanced forms being those that maximally resolve all the preceding tensions. The philosopher does not identify these tensions and their resolutions on a purely speculative basis. He or she first examines the accounts of natural forms provided by scientists, then discerns the tensions within these forms so described, and on this basis rearranges these forms into a sequence from most to least tension ridden. By doing so, the philosopher of nature is simultaneously deriving each form from its predecessor by *a priori* reasoning (Stone, 2018, p.133)

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12 Thomas R. Webb also shares a similar position: "This comprehensive grasp of nature thus involves a double mediation. First, nature is mediated by non-philosophic life, pre-eminently, though not exclusively, by the activity of the natural scientist. On the basis of observation and experiment the scientist arrives at descriptions, correlations and laws which give universal form to the diversity and complexity of the phenomena as they originally present themselves. Already here, as we have noted, there is a partial rise above contingency, namely, above that of the instances which fall under the scientist's laws and concepts. But this rise remains partial because the content of these laws and concepts is itself contingent. Then, in a second mediation, the philosopher of nature takes up these contingent laws and descriptions and gives them an absolute form. In doing so he is guided by the knowledge that nature is a form of the Idea, but this knowledge is only an assurance which must be made good by the actual course of philosophy of nature. Philosophy of nature does not merely 'apply' a schema provided by the Hegelian logic. It has, rather, to *discern* the presence of the Idea in the data provided by empirical science" (Webb, 1980, p.184). Marina F. Bykova sustains something similar: "Hegel advocates for an epistemology grounded in nature, where empirical knowledge is not only possible but also essential, as it forms the basis upon which philosophy constructs its concepts and theories. (..) Therefore, the Philosophy of Nature should not be seen solely as a conceptual exercise, especially not an a priori one. Instead, it primarily concerns the analysis of interactive forces and actual causal relationships prevalent in nature, which are captured by these concepts" (Bykova, 2004, p.87).

In this sense, the positions examined here may appear similar to what Alison Stone, in *Petrified Intelligence*, defines as a weak a priorism, according to which the task of philosophy consists in taking the forms provided by the empirical sciences and then reorganizing them rationally, translating them into logical categories. This means that authors such as Michael John Petry and Gerd Buchdahl had already grasped the dialectical character of the relationship between *a priori* and *a posteriori* in Hegelian philosophy. For Petry, logical structures provide a universal form to which the structure of nature refers. However, since logical structures are universal and abstract, they merely offer general guidelines for how nature should be studied and organized philosophically.[13] According to Buchdahl, as Stone points out, the issue lies not so much in reorganizing the sciences, but rather in the fact that "Hegel completely reinterprets scientific concepts in light of logical categories" (Stone, 2005, p.15). For example, Buchdahl interprets the categories of repulsion and attraction in terms of the logical categories of the one and the many.[14]

Another, similar and more recent position is sustained by Thomas Posch, who affirms that in Hegel the skeleton of the *Philosophy of Nature* is developed conceptually in the *Science of Logic*, but without losing the attention to the borderline events of nature. This means that Hegel's project is not entirely *a priori* and nonempirical – something that can be argue stressing two fundamental points. First, Hegel looks for a correspondence between a natural law and a logical category to give to the former a conceptual necessity. In this way, "the main point to be made about conceptual necessity is that it does not preclude reference to experience. On the contrary, conceptual necessity 'justifies' the content of empirical laws or observations; it is their 'rationalization' by means of dialectics (Posch, 2011, p.182). Second, when we deal with natural details "Hegel does not claim that philosophy should aim at deriving all of them a priori, that is, at proving that all natural phenomena necessarily present themselves in the way they do" (Posch, 2011, p.182). However, in the interpretations of Petry, Buchdahl, and Posch, although one can already discern a dialectic between a priori and a posteriori, this is still understood as a mirroring of natural categories in logical ones. The emphasis remains primarily on the logical categorical system and on the search for correspondence in the natural realm, albeit a freer one compared to strong a priorism.

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13 "The categories of the 'Logic' stand in relation to natural and spiritual phenomena (...). They are an integral part of these phenomena, and yet, on account of their greater simplicity, universality or generality, and on account of the complexity relationships in which they stand to one another as categories, they have also to be regarded as constituting a distinct sphere and as demanding treatment in a distinct discipline" (Petry, 2002, p.42).

14 "In other words, attraction and repulsion must not be introjected ab extemo, but need to be explicated as logical aspects of the Notion involved in the very consideration of matter qua matter, under its aspect of the one and the many" (Buchdahl, 1984, p.25); "From the very outset, repulsion and attraction make their appearance not on account of empirical analysis, but at the logical level, as aspects or moments of being-for-self, where they are treated as purely pictorial expressions of a strictly logical process. It is only later on, when Hegel turns to the construction of matter in the Philosophy of Nature, that they are given any physical significance" (Buchdahl, 1993, p.67).

A position in which the relation between philosophy and empirical sciences appears even more speculative, in my view, is developed by Brigitte Falkenburg, who highlights two fundamental points. First, although there is a correspondence between logical and natural categories, this does not amount to a one-to-one map, since the natural realm always retains a degree of unpredictability and contingency. This implies that, for Falkenburg, a purely *a priori* consideration of nature is not possible. Second, she maintains that the task of philosophy is to assist physics in making the relationship between its laws conceptual — that is, necessary. In this sense, the *Philosophy of Nature* follows the structure of the *Science of Logic*, moving from conceptually poorer stages to richer and more complex ones:

> The philosophical task is to help physics in organizing its concepts into an adequate phenomenological system of natural kinds. In doing so, natural philosophy is committed to *criticizing* physics whenever the preliminary concepts of that science do not denote natural kinds but unobservables, such as atoms, and whenever physics disregards the organization of concepts into an adequate structure in which no concept is universally valid. The systematic order of organizing the concepts of physics into a system of natural kinds is prescribed by the systematic order of conceptual types of structure as expounded in the *Logic*, starting from the most abstract (or structurally poor) concepts and ending up at the most complex (or structurally complete) concepts (Falkenburg, 1998, p.130)

Conclusion: Philosophy and Empirical Sciences

I have tried to show how my interpretation allows to revise the concepts of *a priori* and *a posteriori* according to the Hegelian speculative process. In this way, I managed to avoid the two problems I underlined, respectively, in strong a priorism and a posteriorism, and their generally inadequate application of a Kantian terminology to the Hegelian philosophy. In this reflection on the relationship between philosophy and empirical sciences, paragraphs 7, 9, and 12 of the Introduction to the *Encyclopedia of the Philosophical Sciences in Basic Outline* can be helpful to sustain my interpretation.

In paragraph 7, Hegel highlights how, despite beginning from an empirical standpoint, what the natural sciences "aim at and produce are *laws, general propositions, a theory,* i.e. the *thoughts* of what there is" (Hegel, 2010, p.35, §7R). This implies that a certain affinity already exists between the empirical sciences and philosophy, insofar as both aim to comprehend nature rationally. In this way, it does not seem strange at all to claim that natural categories are the result of a joint effort between these two fields of knowledge, which appear to have much more in common than they do in difference.

In paragraph 9, Hegel underlines how philosophy does not deny or disregard the empirical knowledge of the sciences, "but instead acknowledges and uses it; that it likewise

acknowledges and utilizes as its own content the universal produced by these sciences, such as their laws, genera, etc." (Hegel, 2010, p.37, §9R). This means that, in addition to scientific categories, philosophical thinking will elaborate further categories to render everything organically and conceptually valid. In this sense, philosophy, in relation to scientific categories, "introduces into those categories others as well and validates them" (Hegel, 2010, p.37, §9R). As a result, in the relation between philosophy and science "the difference (…) concerns solely the said modification of the categories" (Hegel, 2010, p.37, §9R). This passage, then, also supports my position, since it is the joint work of philosophy and empirical sciences that gives rise to new natural categories. The empirical sciences alone are not capable of attaining the level of conceptual concreteness that philosophy makes possible, and for this reason a common work of the two is needed.

This movement is also emphasized in paragraph 12, where Hegel shows how philosophy, which initially denies the value of the empirical, is torn away from this abstraction precisely thanks to the sciences themselves. The sciences, for their part, strive to give necessary form to what is given in an immediate way. In this sense, as a result, we arrive at a philosophy that takes the determinations produced by the sciences and reorganizes them according to necessity, in line with the concept:

> Such development consists on the one hand merely in taking up the content and its given determinations and at the same time bestowing upon them, on the other hand, the shape of a content that emerges purely in accordance with the necessity of the subject matter itself, i.e. a shape that emerges freely in the sense of original thinking (Hegel, 2010, p.40, §12)[15]

Precisely in this paragraph, Hegel mentions the *a priori* and the *a posteriori*. He first addresses the relationship between immediacy and mediation, showing how "although both moments *appear* to be distinct, *neither of them* may be absent and they form an *inseparable* combination" (Hegel, 2010, p.40, §12R). This is also valid for the relationship between *a priori* and *a posteriori*, which need to work together and operate speculatively. This is reflected in the relationship between philosophy and empirical sciences. Hegel emphasises how the claim that philosophy begins with experience implies something deeper than merely distancing itself from it in order to become formal and abstract thought. On the contrary, philosophy must begin with experience (and so, operating *a posteriori*) to elaborate it according to the *a priori* principle of freedom:

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15 See also: "The Philosophy of Nature takes up the material which physics has prepared for it empirically, at the point to which physics has brought it, and reconstitutes it, so that experience is not its final warrant and base. Physics must therefore work into the hands of philosophy, in order that the latter may translate into the Notion the abstract universal transmitted to it, by showing how this universal, as an intrinsically necessary whole, proceeds from the Notion" (Hegel, 2004, p.10, §246R).

> On the one hand, the empirical sciences do not stand still with the perception of the details of the appearances; instead, by thinking, they have readied this material for philosophy by discovering its universal determinations, genera, and laws. In this way, they prepare this particularized content so that it can be taken up into philosophy. On the other hand, they thus make it necessary for thinking to proceed to these concrete determinations by itself. The process of taking up this content, in which thinking sublates its mere givenness and the immediacy that still clings to it, is at the same time a process of thinking *developing* out of itself. Insofar as philosophy owes its development to the empirical sciences, it bestows upon their contents the most essential shape of the *freedom* of thought (i.e. the shape of the *a priori*) and, instead of relying on the testimony of their findings and the experienced fact, provides their contents with the *corroboration of being necessary*, such that the fact becomes the depiction and the replication of the original and completely independent activity of thinking (Hegel, 2010, p.41, §12R)

To conclude, let me clarify how the issues relating to the *a priori* and the *a posteriori* positions are resolved. First, the problem posed by strong a priorism is solved, as the empirical sciences no longer have the task of simply filling in a set of logical categories already developed *a priori*. On the contrary, there is no longer a dualistic and hierarchical logic of form and content: the task of philosophy is to leave the sciences – which are already highly rational – free to develop, without getting in the way of their work with *a priori* categorizations. Second, the problem posed by a posteriorism is also solved. As already underlined, we need to avoid considering the contingency of nature as already proven *a priori* in the logical treatment of necessity and contingency: rather, the contingency of nature appears distinct to the logical one, since it has to do with the unpredictability of natural phenomena. The reading supported here can guarantee this: philosophy does not try to grasp or prove *a priori* the contingency of nature – this is left to the study of the empirical sciences.

What remains to be understood is how the interpretation supported here can account for an exhaustive relationship between philosophy and empirical sciences. Hegel states that both disciplines have a commonality of nature, insofar as both deal with the process of thinking.[16] Their difference lies in the fact that philosophy only has thought as an instrument, while the sciences, aiming to create universals, take the empirical fact as a basis or starting point. The form of philosophy, thus, is a form of its own, the concept.[17] For Hegel,

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16 In fact, Hegel himself states that the laws of the empirical sciences aim to produce "the *thoughts* of what there is" (Hegel 2010, p.35, §7R) and that physics is "a *theoretical* and indeed a *thinking* consideration of Nature" (Hegel 2004, p.6, §246).

17 "The process of thinking over that is directed towards satisfying this need is genuinely philosophical thinking, *speculative thinking*. This process of thinking things over is both the *same* as and *different* from the former process of thinking them over and, as such, it possesses in addition to the shared forms of thinking *its own peculiar forms*, of which the *concept* is the general form (Hegel, 2010, p.37, §9).

this does not mean that philosophy denies empirical discoveries: on the contrary, it is precisely from these that it starts – and so, in this way, it is *a posteriori* – and then organically organizes them into a systematic whole – thanks to an *a priori* principle of necessary unity. What does this mean? It means that philosophy succeeds, thanks to the form of the concept – which is derived from the pure thought that takes place *a priori*, without reference to experience – to do what science does only in part, that is to give organic and systematic form to nature. Philosophy, which starts from the result of empirical sciences, can give a conceptual unity to the empirical scientific laws thanks to the principle of systematic unity, based on pure thought alone.

To conclude, according to this perspective, philosophy does not play a fixed role with respect to the empirical sciences, but an active one, since this systematic union of scientific laws consists in a constant and dynamic work: every single law, we could say, "counts" and when one of these changes, then the systematic order must reorganize itself. This has an important implication for the *Philosophy of Nature*: following each new scientific discovery, it always needs to be modified and adjusted, to ensure the organic union of the laws currently valid in the scientific field. This means that the *Philosophy of Nature*, and Hegelian philosophy in general, is not a static and definitive system, but a constant work in process.

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