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Matter and Motion in Kant's Philosophy of Science

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Meghant Sudan

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Abstract of the Dissertation

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This dissertation examines Kant's project in his *Metaphysical Foundations of Natural Science* to present a 'critically' approved account of physical entities, purportedly necessary for all scientific investigation. It develops an original interpretation of its key programmatic premises, which revolve around the attribution of motion to matter as a way of making further a priori claims about outer things in general. It clarifies the connections these premises have to central doctrines of the *Critique of Pure Reason* such as Kant's theories about mathematical cognition and the constitution of perception according to sensation. Fatal flaws in Kant's project, however, compel revisions that affect those very doctrines that were supposed to provide a prior basis for it. The dissertation outlines these problems and the corresponding revisions with the help of Hegel's surprisingly sympathetic and detailed criticisms of Kant's *Metaphysical Foundations*. This has the added benefit of showing how Hegel's own philosophical approach is much more intimately informed by Kant's said project than it initially appears. In sum, Kant is asked to relinquish his transcendental-psychological framework in favor of an account of perception which is immanently reflective and which rests on rational-physical bases instead of providing an allegedly subjectivist basis for the latter. This result issues a challenge for us to think such revisions without helping oneself either to a blatant Hegelian rationalism or an anachronistic naturalism foreign to Kant.

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Introduction

This dissertation focuses on Kant's *Metaphysical Foundations of Natural Science*, in which Kant hopes to establish the grounds for physics as a rational science by means of the doctrines already developed in the *Critique of Pure Reason*. The latter promised to demonstrate the very possibility of metaphysical theory and the former text appears to cash out that promise by delivering a particular metaphysical account that Kant believes useful and necessary for physicists and philosophers alike. The two central concepts chosen for this purpose are the concepts of matter and motion and Kant tries to spell out what we know a priori about and through them. It is clear that with such an inquiry he has set his sights upon some of the basic assumptions of the modern scientific revolution.

But several questions arise about the said concepts and the knowledge they make possible: Are they empirically acquired concepts and in that case how can we have a priori knowledge about the particular given empirical objects they designate? How do the metaphysical principles that purportedly provide such knowledge stand with respect to the transcendental principles that govern the general form of nature and experience? Which specific elements of his philosophy of mathematics and his transcendental psychology does Kant make use of in theorizing with these concepts and are those elements or their applications justified in themselves?

The *Metaphysical Foundations* does not have entirely satisfactory answers to these questions and Kant himself is forced to reconsider its central premises in his later

writings. Aside from the intrinsic philosophical interest in inspecting the specific failures of this text, I show how they are especially instructive when considered in respect of their derivation from and impact upon key items of the transcendental-critical framework of the *Critique of Pure Reason*. The source of these failures, at bottom, are found to lie in Kant's view that an a priori, formal-constitutive, transcendental scheme can be specified for non-intentional mental episodes crucial to all perception, i.e., sensations. Just such a transcendental scheme, Kant believes, can help align abstract mathematical-physical speculations with his transcendental theory of experience insofar as they both claim to articulate the particulars given in experience as to their constitutive a priori characteristics. But I show Kant's efforts to flesh out this belief are in vain and he is trapped between the unhappy options of either not getting his pure formal account of experience at all or of making a natural-scientific theory of matter a part of that account.

Finally, I discover that Hegel's own criticisms of the *Metaphysical Foundations* work out a strikingly similar line of insights, while inclining to the second horn of the dilemma above as offering a more successful strategy. Reading these criticisms constructively helps outline revisions that Hegel suggests to the Kantian program: in particular, that Kant should give up parts of his theory of an internally self-sufficing transcendental imagination that conjures mathematical-physical manifolds of space and time from its own resources and, instead, embrace a more realist version of the dialectical unities of space and time and of matter and motion, which he develops in his own philosophy of nature. This revision would be undertaken from a position extremely sensitive to the Kantian one and is really an offer Hegel makes which Kant cannot refuse.

The first chapter, "Fundamental Concepts and Tasks of Kant's Meta-Physics," provides an overview of the main terms and the central argument for the project of the *Metaphysical Foundations*. It discusses initial worries about the consistency of this project with respect to Kant's architectonic of the rational sciences at large and registers concerns about related terminological ambiguities. At the same time, enough reason is found to allay the initial worries, but an inventory of the more serious difficulties is assembled, which organizes the inquiries conducted in the remainder of the dissertation.

The second chapter, "The Role of Motion in Understanding Matter," claims that any substantive response to the various problems mentioned in Ch.1 requires complete clarity about the starting point of Kant's theory in the *Metaphysical Foundations*, his definition of matter as the movable in space. By means of an original interpretation, this definition is shown to follow from a previous and obscure claim to the effect that motion is the fundamental determination of matter. I base my interpretation on certain doctrines elaborated in the *Critique of Pure Reason*, namely, the theory of the *transcendental imagination* and the concept of *construction* in Kant's philosophy of mathematics. I defend my view against other interpretations that read this definition in the context of reading the *Metaphysical Foundations* as either too close or too antagonistic a relation to the *Critique of Pure Reason*: as either offering a similar transcendental argument to the conditions of possibility of "outer" experience or being incompatible with its key premises; but Kant is seen to be evolving a much more tentative approach that accordingly requires a nuanced and charitable manner of reading this relation.

The third chapter, "Kant's Phoronomical Theory and the Problem about Sensation," evaluates the position arrived at in the previous chapter by testing the fitness

of Kant's definition for the very uses it is put to in the *Metaphysical Foundations*. I focus on the relatively undocumented terrain of Kant's phoronomical theory of matter and find two problems therein: a possible circularity in Kant's procedure to "construct" the phoronomical concept of matter (i.e. demonstrate its possibility per composition in pure intuition), and a certain incoherence in the concept of "empirical space" that Kant introduces as crucial to this construction. The problems are shown to have their source in the principle called the "Anticipations of Perception" in the *Critique of Pure Reason*, which allegedly ascribes a priori intensive magnitudes to the object of sensation, which is tacitly assumed in its application to the sensible perception of motion in the present case. But this principle is itself seen to be unsteady and, moreover, it seems to stand in need of the matter-theory to which it is applied. This leaves Kant with a set of serious structural problems that invite equally serious revisions to the conceptual framework espoused in the *Critique of Pure Reason*.

The fourth chapter, "Hegel's Criticisms of Kant's Special and Critical Metaphysics," studies Hegel's criticisms of Kant's efforts in the *Metaphysical Foundations* as they are expressed mainly in certain sections of his *Science of Logic* and his *Philosophy of Nature*. Scratching beneath the (sarcastic and pejorative) surface of these criticisms, as is rarely done, one finds a wealth of insights into precisely the abovesaid source of Kant's problems, namely, that Kant tries to establish the metaphysical bases of his theory upon a transcendental account of sensation. Hegel is also keen to expose the naivete of Kant's preferred methodological device in the *Metaphysical Foundations*, "construction," because, I would argue, it is a precursor to his own dialectical method of the concretion of conceptual forms. As a result, Hegel

effectively suggests two important revisions to Kant's picture: first, we need to discard the quasi-mathematical notion of construction and look to a dialectical-conceptual unity of the concepts of matter and motion in order to secure the rational basis of physics; second, we need to discard the transcendental-psychological framework of Kant's efforts and replace it with an immanently reflective account of perception grounded on those very rational-physical bases. I take care through all this to avoid imposing an anachronistically naturalistic standpoint to either Kant or Hegel merely in order to support my view. Yet the dialogue between them, as I present it, should serve as a template for entering contemporary discussions that seem to have unfolded along similar lines, namely, stressing a greater role for a linguistically turned empirical psychology and a naturalized metaphysical bent of mind in place of (or even in the context of) a formal analysis of the egoic acts of transcendental subjectivity.

Chapter 1

Fundamental Concepts and Tasks of Kant's Meta-Physics

In the *Metaphysical Foundations of Natural Science*, Kant extends the philosophical results of his *Critique of Pure Reason* in order to articulate the principles upon which the field of inquiry of physics rests, where the latter is understood as a proper scientific theory of matter or body. It behooves us to study the methods, elements and objects of Kant's philosophy especially in this aspect, where it not only provides a critique of metaphysical knowledge, but indeed goes on to develop such metaphysical knowledge.

The *Metaphysical Foundations* undertakes a close analysis of the central concept of a physical or natural science, a particular type of object variously called "matter," "body," "object of outer intuition," "corporeal nature," etc. These locutions are not equivalent and we will have to see what semantic precisions are to be found and/or made in Kant's theory. Equally, there are a plethora of descriptions to be sorted out on the methodological front, i.e., with regard to the task of "grounding" a natural science – which is variously expressed as "applying the categories as predicates of matter," "specifying general transcendental laws of nature," "providing an example *in concreto* for general metaphysics," "laying the groundwork for a mathematical physics," the becoming-science of a mere doctrine of body, etc. Assessing Kant's attempt at providing the absolutely certain guidelines, fundamental concepts, and a priori principles for

investigation into a crucial sphere of theoretical interest, thus, first requires clear apprehension of the terminology Kant uses to set up his methodological and objective framework.

Our inquiry also needs to be sensitive to both the historical context of Kant's reflections as well as the tentative nature of his philosophical analyses. The main historical context necessary for demystifying these texts is the modern scientific worldview that struggled to reconcile the ruptures between philosophical and natural-scientific viewpoints occasioned by what may be called a post-Aristotelian or Galilean approach, or as is more familiar to us, by the Newtonian world that unfolds with the "scientific revolution." Kant's remark in the *Jäsche Logic* in a section titled "Short Outline of a History of Philosophy" is instructive: "Philosophy owes its improvement in recent times partly to the intensified study of nature, partly to the connection of mathematics with natural science. The orderly thinking that arose through the study of these sciences spread over the special branches and parts of philosophy proper."[1]

I shall extend this historical-mindedness a little to post-Kantianism as well, in considering some of Hegel's responses to Kantian problems. By the second feature, tentativeness, I refer to the fact that the *Metaphysical Foundations* was written between the two editions of the *Critique of Pure Reason*, and that the impetuses and restraints that

[1] Kant (1988), 36; Ak.9:31-32: "Ihre Verbesserung in den neueren Zeiten verdankt aber die Philosophie theils dem größeren Studium der Natur, theils der Verbindung der Mathematik mit der Naturwissenschaft. Die Ordnung, welche durch das Studium dieser Wissenschaften im Denken entstand, breitete sich auch über die besonderen Zweige und Theile der eigentlichen Weltweisheit aus." I will refer to Kant's works throughout by first citing the translation (when available), followed by the volume (x) and page (y) numbers of the Akademie edition after a semi-colon in the standard format (Ak.x:y). Citations from the *Metaphysical Foundations* will be indicated by "MFNS" followed by the standard Akademie pagination format and those from the *Critique of Pure Reason* will be indicated by the usual "A/B" convention followed by the standard Akademie pagination format.

the former develops for Kant's thinking are registered in the alterations made to the second edition. Also, problems of interpretation arise in thinking the systematic place of the *Metaphysical Foundations* vis-à-vis Kant's projected yet never written Metaphysics of Nature. And finally, as far as the *Metaphysical Foundations* itself is concerned, it is well known that Kant found it necessary to revise its fundamental theses all the way to the end of his philosophical career. Even if we don't get the chance here to delve into the fascinating details of these revisions as presented in posthumously published material, we will rely all through on a principle of charitable interpretation whereby one looks to nurturing the progress of a philosophical germ rather than judging a fully fledged theory. The *Metaphysical Foundations* contains several internal problems and commentators are unanimous on the unsurpassable damages wreaked on Kant's project in the book, but they have focused on how this relates to Kant's later work inasmuch as the latter is stirred by the failings of the former. In my dissertation, on the other hand, I want to linger with the relations Kant's project has to its own present dimensions, namely, the relation between the *Metaphysical Foundations* and the *Critique of Pure Reason*. This aspect has been neglected to a certain extent and my interpretation takes as its guiding theme the need to highlight these interconnections.

As a result of our investigations we will find that we have to read the roles of some of the principal actors of the Kantian story in a new way, as we uncover in the transcendental deduction of the categories *a resource for guiding further metaphysical application of concepts* and as we look to the joint work of the concepts of matter and motion *as primordial factors in cognition* beside the usual suspects for the job, i.e., the pure concepts of the understanding and the pure forms of sensibility, such that we can

eventually appreciate *the contributions of the Kantian faculty of imagination* beyond just synthesizing givens and toward modeling possible regions of human inquiry. We are still a fair distance from this, however, and we must prepare a lot of ground to expand Kant's critical devices toward these ends. Section I of the present chapter makes some general observations about the method and fundamental concepts of Kant's program in this text; Section II recounts the arguments Kant uses to establish the specific tasks of his book; Section III tackles an initial difficulty that may disable the sense of the whole project, before we turn to more specific problems and their solutions in the second chapter.

I. Overview of the *Metaphysical Foundations*

How does the *Metaphysical Foundations* go about securing the metaphysical bases from which a proper physics can follow? Kant's own answer to this question is laid out in the *Preface* of this book and I shall first concentrate on collecting the various elements of this answer. In the present section, I image the general shape of the project by characterizing its aims and methods as an analytical inquiry (I.1) and by introducing the fundamental concepts Kant makes use of – *nature*, *matter*, and *motion* (I.2).

I.1 General Aim & Method: Kant does not conceive this exercise as a synthetic-deductive one. For instance, it does not model itself after the Cartesian manner of

deriving the laws of nature from the notion of corporeal substance, that is, from the concept of extension that defines its essence and from the concurrent activity of divine preservation that defines its existence.[2] Instead, the *Metaphysical Foundations* appears to proceed in an *analytic-regressive* way; it assumes that we possess a stock of empirical knowledge about the behavior of material entities and proceeds to the discovery of principles that merely intend an order in that knowledge. Kant calls the unordered (or randomly collated) information a "doctrine of nature" (*Naturlehre*), and the (truly) ordered knowledge, "proper natural science" (*eigentliche Naturwissenschaft*). For Kant, being properly ordered means the systematic arrangement of cognitions according to a priori principles that guarantees the apodictic certainty of those cognitions. The idea here is easy enough to understand: only once we intend the form of a demonstration amongst propositions, does the whole acquire explanatory weight and cease to be a random assortment of statements. There may of course be several ways of ordering information that lead to different degrees of explanatory success, but Kant thinks it is possible to specify a unique way of creating proper scientific form across this information according to fundamental rational principles. Precisely in what the said ordering and the genuine scientific form it produces consists, will be seen in Section II below.

What prompts the idea that Kant's project is an analytic venture? Initially, I merely note the following and a full answer will only appear in Chapter 2:

1) One may think it analytic to the extent that we approximately understand by an analytic method the search for the conditions of a problem taken as solved and to the extent that Kant assumes as given scientifically formed cognition of physical nature as

[2] Cf. Descartes (1983), Bk. II.

such and asks about its principles.[3] That is, the problem requiring a solution in this case is the very possibility of natural science and by supposing this to have been realized (i.e., that *there is* such a thing as natural science), Kant works back to the conditions and principles of its possibility.

2) Or one might say that the assumption being made here is not about natural science *as such* but a particular natural-scientific doctrine that seems to Kant to be the correct one. Kant, then, infers back to the conditions of possibility of this particular doctrine, and the inquiry comes to a rest when we arrive at the transcendental laws of nature that have already been acknowledged as principles of the cognition of nature in general in the *Critique of Pure Reason*. Now, which particular doctrine Kant holds to be a good exemplar of actual natural science is not indicated by him clearly and one may accordingly try and find the propositions of a particular natural scientific scheme of the day that Kant relied upon in the propositions he appears to assume in the text as given. A variation of this idea also leads us to consider whether, instead of a particular scientific scheme, a naturalism of sorts underwrites the analytic inquiry. That is, the propositions assumed as given, the problem taken as solved, would refer not to a Newtonian, Cartesian, or Leibnizian natural-scientific scheme, but to ordinary empirical propositions. Implicit in this idea would be the claim that we know something about matter actually

[3] A classic statement of the analytic procedure is by Pappus: "*Analysis*, then, takes that which is sought as admitted and passes from it through its successive consequences to something which is admitted as the results of a synthesis; for in analysis we admit that which is sought as if it were already done and we inquire what it is from which this results and again what is the antecedent cause of the latter, and so on, until by so retracting our steps we come upon something already known or belonging to the class of first principles, and such a method we call analysis as being solution backwards." In the *Prolegomena*, Kant describes the analytic method as regressive and signifies "that one proceeds from that which is sought as if it were given, and ascends to the conditions under which alone it is possible." (Kant [2002], 73; Ak.4:276n.: "…daß man von dem, was gesucht wird, als ob es gegeben sei, ausgeht und zu den Bedingungen aufsteigt, unter denen es allein möglich.")

from experience and what is being sought is the connection between this empirical epistemic state and the transcendental epistemic grounds already recognized as true (the principles of the pure understanding). This way of framing the issue leads one to think that the challenge Kant faces in this text is to provide a grounding account of uncontroversial empirical cognitions. He has already made an initial foray in this direction in talking about the regulative employment of reason in the *Critique of Pure Reason*, where it was argued that reason must envision a system of concepts to guide the understanding's actual cognitive progress through experience. But, as Kant was following a synthetic procedure by his own admission there, it may be thought that the *Metaphysical Foundations* provides, on the other hand, a correlative analytic procedure by starting from actual empirical cognitions, and uses cognitions about matter as a test case. This line of interpretation fits well with the kind of questions Kant brings up in his *Critique of the Power of Judgment*, which too look to the cognitive structures involved in empirical knowing, and the *Metaphysical Foundations* would be a station on the way to theorizing empirical as distinguished from transcendental knowledge.

3) Finally, one may remember that Kant explicitly describes the philosophical labor demanded by this project as consisting in the "complete analysis [*Zergliederung*] of the concept of a matter in general… a task for pure philosophy" (MFNS 187; Ak.4:472), where the expository analysis of a certain concept of matter somehow provides a clue to thinking the analyticity of the method followed in the text as a whole.

I.2 Fundamental Concepts: The fundamental concepts invoked in this project are "nature," "matter," and "motion." The meanings of these concepts appear inexact on account of their being over-determined by myriad concerns both internal and external to Kant's philosophy. I record these over-determinations below with the aim of showing that only on the strength of a clear grasp of Kant's argument for the project (see section II of this chapter and sections I and II of the next) is one able to sort through them.

***A. Nature*:** To understand the sense of "nature" relevant for understanding the subject matter of this text, Kant introduces a distinction between the formal and material senses of nature, *natura formaliter spectata* and *natura materialiter spectata*. The text's brevity confuses more than enlightens, since Kant does not comment on the way he is carving up the domain of natural science and because it seems that he is both rejecting and espousing the formal sense of nature in doing so. In this sub-section, I will merely add some clarifying comments to his condensed discussion. Of the said distinction, Kant says:

> If the word nature is taken simply in its *formal* meaning, where it means the first inner principle of all that belongs to the existence of a thing*, then there can be as many different natural sciences as there are specifically different things… But nature is also taken otherwise in its *material* meaning, not as a constitution, but as the sum total of all things, insofar as they can be *objects of our senses*, and thus also of experience. Nature, in this meaning, is therefore understood as the whole of all appearances, that is, the sensible world, excluding all nonsensible objects. Now nature, taken in this meaning of the word, has two principal parts, in accordance with the principal division of our senses… In this meaning, therefore, a twofold doctrine of nature is possible, the *doctrine of body* and the *doctrine of soul*, where the first considers *extended* nature, the second *thinking* nature.

*Essence is the first inner principle of all that belongs to the possibility of a thing.[4]

As treating of a philosopheme of lasting interest, we obviously cannot take Kant's introductory passage on the two senses of "nature" as having dealt with the issue in a final way. Kant's entire philosophical oeuvre battles with this concept, especially in its modern form, which measures its estrangement from an Aristotelian interpretation of the same. The fact of nature itself is relatively uncontroversial,[5] and yet, for Kant, the question – "how is nature itself possible?" – is the philosophical question *par excellence*: "This question – the highest point that transcendental philosophy can ever reach, and to which, as its boundary and completion, it must proceed…"[6]

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[4] MFNS 183&n; Ak.4:467&n: "Wenn das Wort Natur blos in formaler Bedeutung genommen wird, da es das erste, innere Princip alles dessen bedeutet, was zum Dasein eines Dinges gehört,* so kann es so vielerlei Naturwissenschaften geben, als es specifisch verschiedene Dinge giebt... Sonst wird aber auch Natur in materieller Bedeutung genommen, nicht als eine Beschaffenheit, sondern als der Inbegriff aller Dinge, so fern sie Gegenstände unserer Sinne, mithin auch der Erfahrung sein können, worunter also das Ganze aller Erscheinungen, d.i. die Sinnenwelt mit Ausschließung aller nicht sinnlichen Objecte, verstanden wird. Die Natur, in dieser Bedeutung des Worts genommen, hat nun nach der Hauptverschiedenheit unserer Sinne zwei Haupttheile, deren der eine die Gegenstände äußerer, der andere den Gegenstand des inneren Sinnes enthält, mithin ist von ihr eine zwiefache Naturlehre, die **Körperlehre** und **Seelenlehre,** möglich, wovon die erste die ausgedehnte, die zweite die denkende Natur in Erwägung zieht.

"* Wesen ist das erste, innere Princip alles dessen, was zur Möglichkeit eines Dinges gehört."

[5] Kant seldom clarifies "nature in general," with which we are presumably acquainted in some basic way. Also, see Aristotle (1961), 24 (*Physics* ii.1.193a3): "It would be ridiculous, however, to try and prove *that* nature is: it is obvious that there are many such natural beings". The standard reading of "obvious" is that it is simply "manifest to the senses" (e.g. Aquinas [1999], 78), but for an alternative reading of this obviousness, see Heidegger (1998), esp. pgs. 201-3. Also, we shall come to see in my chapter 4 below that Hegel does not think it so ridiculous to try and prove that nature is.

[6] Kant (1977), 60; Ak.4:318: "Diese Frage, welche der höchste Punkt ist, den transscendentale Philosophie nur immer berühren mag, und zu welchem sie auch als ihrer Grenze und Vollendung geführt werden muß…"

The formal and material senses of "nature" mention only one aspect of nature among others, such as its technical aspect, its beauty or sublimity, its opposition to the sphere of morality, etc. Even the present terminological division is taken from traditional discourse, which hearkens back to Aristotle's characterizations of nature,[7] while closer to Kant, of course, are the versions of Wolff and Baumgarten.[8] However, Kant adds his own peculiar slant to these terms, the weight of which clearly falls on the second term, nature viewed materially. For "nature" in the formal sense of the word, the sense contrasted with essence in the footnote, indicates the form of a thing considered as actual and not merely possible, and implies the principle of determinations belonging to the species of that thing. Since there may be many species of things, the formal sense of nature would invoke as many natures and consequently would give rise to as many natural sciences.

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[7] See his *Metaphysics* v.4.1014b16-1015a19 and Book II of his *Physics* ii.1.192b32ff. The latter text presents an intriguing companion to Kant's Preface, despite the epochal chasms separating them. In this book, according to Aquinas' paraphrase, "*After* the Philosopher has treated the *principles of natural things* in Book I, he here treats the *principles of natural science*" (Aquinas [1999], 74; my emphases). Summarily viewed, this treatment contains three main moments: articulating the formal and material senses of nature; comparing mathematical and physical-scientific modes of investigation; using the earlier moments to formulate the method and elements of natural science in terms of the doctrine of the fourfold cause. Kant's preface contains just these moments; the epochal chasm that nonetheless marks this structural similarity affects the respective guiding ideas – the analogy to art (*techne*) in an interpretation of a thing of nature in Aristotle and the interpretation of a thing of nature as appearance in Kant. This chasm in interpretations will again be reconfigured later in the *Critique of the Power of Judgment*.

[8] Ch. Wolff: "And insofar as it [something] is an active thing, one attributes a *nature* to it: accordingly, nothing else is to be understood by *NATURE* than an active force that is determined in its mode by the *essence* of a thing." A G Baumgarten: §35: "The sum total of essential components in something, or the inner possibility of something, is *essence*"; §311: "The *nature of a thing* is the sum total of those of its inner determinations which contain in themselves the ground of the actuality of its alterations, or of its accidents as such"; §338: "The sum total of the natures of all parts of the world, taken individually and all together, is the *whole nature* (*natura vniuersa, naturata*)." (Baumgarten [2004]: 15, 92, and 102 respectively; my translations.) Also, cf. Kant: Ak. 29:820ff, 933, Kant (1988): 67; Ak.9:61 etc.

In rejecting this view, Kant emulates the modern disavowal of the peripatetic scientific approach based on the forms and qualities of things. In taking up nature viewed materially as a better candidate for the object of such a science, Kant looks to the totality of things under the cognitive restriction to the objects of the senses or appearances. Thus, the nature at stake in a natural science is "the whole of all appearances" and since appearances may be divided according to the division in type of sense – inner and outer – the collection and the doctrinal cognition thereof divide accordingly. Yet, the formal sense of nature does not drop out entirely; in the same preface, Kant will reiterate the role of the concept of law (or of principles regulating the determinations that belong to the existence of a thing), which derives from the concept of nature viewed formally.[9]

In sum, Kant construes natural science as treating the principles regulating a collection of existing things rather than a tabulation of various species of things. The latter is either relegated to a non-scientific descriptive affair or taken into account by a critique of our subjectively grounded hopes in regard to the same. It should be noted in connection that Kant, in the *Critique of Pure Reason*, distinguishes two ways of considering this collection, and that the term "nature" properly applies to only one of them:

> We have two expressions, *world* and *nature*, which are sometimes run together. The first signifies the mathematical whole of all appearances and the totality of their synthesis in the great as well as in the small… But the very same world is called nature, insofar as it is considered as a dynamic whole and one does not

[9] No less than four times: MFNS 183, 184, 185; Ak.4:468, 469, 470.

look at the aggregation in space or time so as to bring about a quantity, but looks instead at the unity in the *existence* of appearances.[10]

All this is (at least terminologically) quite clear and consistent with the way Kant uses "nature" in other texts.[11] It is this very consistency that prompts us to ask about what is, then, peculiar to the present project? What is it that makes the latter an application of the principles whose possibility and legitimacy were secured in the *Critique of Pure Reason*? What seems significant is that Kant takes up a classification of the totality of appearances on the basis of kinds of sense-objects (outer and inner) and this somewhat loose 'ordering' of nature leads into the ordering held to be proper to establishing natural science. We will return to this complex of issues in II.2.ii in piecing together Kant's arguments for the constitution of the object of natural science.

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[10] A418-9/B446-7: "Wir haben zwei Ausdrücke: **Welt** und **Natur,** welche bisweilen in einander laufen. Der erste bedeutet das mathematische Ganze aller Erscheinungen und die Totalität ihrer Synthesis im Großen sowohl als im Kleinen… Eben dieselbe Welt wird aber Natur genannt, so fern sie als ein dynamisches Ganzes betrachtet wird, und man nicht auf die Aggregation im Raume oder der Zeit, um sie als eine Größe zu Stande zu bringen, sondern auf die Einheit im Dasein der Erscheinungen sieht."

[11] That is, "nature" generally refers to the law-bound collection of appearances, though one or the other aspect may be highlighted depending on whether the laws essentially refer to a theory of substance and causality, or to the domain of experience where they hold, or to their form-giving capacity in regard to cognition. Accordingly, Kant can speak of nature in the following ways: "[B]y 'nature' taken substantively (*materialiter*) is understood the sum total of appearances insofar as these are in thoroughgoing connection through an inner principle of causality." (A419n/B446n: "…versteht man unter Natur *substantive* (*materialiter*) den Inbegriff der Erscheinungen, so fern diese vermöge eines innern Princips der Causalität durchgängig zusammenhängen."); "By nature (in the empirical sense) we understand the combination of appearances as regards their existence, in accordance with necessary rules, i.e., in accordance with laws." (A216/B263: "Unter Natur (im empirischen Verstande) verstehen wir den Zusammenhang der Erscheinungen ihrem Dasein nach nothwendigen Regeln, d.i. nach Gesetzen."); "Categories are concepts that prescribe laws a priori to appearances, thus to nature as the sum total of all appearances (*natura materialiter spectata*)… [A]ll appearances of nature…stand under the categories, on which nature (considered merely as nature in general) depends, as the original ground of its necessary lawfulness (as *natura formaliter spectata*)." (B163-165: "Kategorien sind Begriffe, welche den Erscheinungen, mithin der Natur als dem Inbegriffe aller Erscheinungen (*natura materialiter spectata*) Gesetze *a priori* vorschreiben… alle Erscheinungen der Natur, ihrer Verbindung nach unter den Kategorien stehen, von welchen die Natur (bloß als Natur überhaupt betrachtet) als dem ursprünglichen Grunde ihrer nothwendigen Gesetzmäßigkeit (als *natura formaliter spectata*) abhängt.")

B. ***Matter:*** This is the main concept discussed in the *Metaphysical Foundations* and its various ambiguities listed below threaten the entire project:

(i) *"Body"*: We have already seen that various expressions are employed in talking about matter that are not all equivalent, e.g., "matter" and "body" and "objects of outer intuition", etc. We ordinarily take bodies to be a more concrete determination of matter and if we equate bodies with matter, a priori cognitions about matter may be inadequate for understanding bodies, and the subject matter of physics would be the poorer for it. Kant recognizes this difference between body and matter:

> One distinguishes matter and body. By matter one always understood something passive that lies at the basis of all appearances. – Body would be the active principle. That is false. No substance is merely passive – if matter is substance, and that lies in its concept, then it is active, otherwise no motion could inhere in it; one must characterize it thus: matter determined with respect to figure and quantity is body.[12]

In the *Metaphysical Foundations*, he says: "A *body*, in the physical sense, is *a matter between determinate boundaries* (which therefore has a figure)."[13] The more concrete determination is here held to consist in a determinate spatial feature, though this obviously does not deny that matter is spatial in some general sense. The previous quotation taken from Kant's lecture notes registers the enormously convoluted context of the distinction, where Kant

[12] From *Metaphysics Mrongovius*, in Kant (1997), 198; Ak.29: 841.

[13] MFNS 235; Ak.4:525: "Ein **Körper** in physischer Bedeutung ist eine Materie zwischen bestimmten Grenzen (die also eine Figur hat)."

contests an allegedly Leibnizian notion of bodies as endowed with active moments and forces belonging to a complete substance, whereas matter as such would be mere passivity and could not be said to exist in this way.[14] Kant sometimes explains his anticipatory use of the term "body" even where the context does not fully permit it, e.g., in the course of phoronomical investigations into the merely logical subject of motion: "If the expression 'body' should nevertheless be used here, this is only to anticipate to some extent the application of the principles of phoronomy to the more determinate concepts of matter that are still to follow…"[15]

This leaves unclear how these "more determinate concepts of matter" amount to the concept of body or exactly when (whether in this book or somewhere else); nevertheless, we gather an initial glimpse into this issue as embroiled in Kant's complex reinterpretation of Leibnizian philosophy. Yet another aspect to this issue may be gleaned from Kant's statement, "A mass of determinate shape is called a *body* (in the mechanical meaning)."[16] Here one sees the concepts of matter and body engaging a central technical item of Newton's theory, mass: "*Quantity of matter is a*

[14] In short, the 'passivity of matter' and 'activity of bodies' brings with it the whole gamut of problems about the relation of a monadic level of formal substance-structures with the phenomenal one, and most importantly, about *spatial relations* as founded upon non-spatial monads and phenomenal *causal relations* founded upon universal harmony. Also, it should be noted that the given remark is read well against Baumgarten's *Metaphysik* §206-208 (Baumgarten [2004], 59-60) than directly Leibniz himself.

[15] MFNS 194; Ak.4:480: "Wenn gleichwohl der Ausdruck eines Körpers hier bisweilen gebraucht werden sollte, so geschieht es nur, um die Anwendung der Principien der Phoronomie auf die noch folgende bestimmtere Begriffe der Materie gewissermaßen zu anticipiren…"

[16] MFNS 246; Ak.4:537: "Eine Masse von bestimmter Gestalt heißt ein Körper (in mechanischer Bedeutung)."

measure of matter that arises from its density and volume jointly…I mean this quantity whenever I use the term 'body' or 'mass' in the following pages."[17]

In this regard, the issue of matter and body is implicated in other ideas about the quantity of matter and motion, which, in turn, were caught up in the *vis viva* controversies between Cartesians and Leibnizians[18] and which had captivated Kant early on.[19] In addition, one should be alert to the role that "measure" plays in these deliberations as a category of natural scientific thought in general (i.e., not only in its Newtonian version), which will receive much attention at the hands of Hegel, among others. In a word, the greater determinateness of "body" over "matter" is tied with both the thought of mere spatial or geometrically identifiable properties of sense objects and the possibility of other quantitative measurements of these objects such as volume and density, to use Newton's words above.

(ii) *"Outer Object"*: From another side, when matter is described as an object of outer sense or outer intuition[20] and physics is said to busy with crafting laws for this alone, this leads to the impression that its subject matter would be restricted to observable middle-sized empirical things alone and that Kant intends a banishment of all else from its province. This simply cannot be true and the false impression stems from two sources. Firstly, it arises from confounding two themes with each other: the

[17] Definition 1 in Newton's *Principia*. (Newton [1999], 403-404)

[18] Calinger (1969), Iltis (1971) & (1973) give a good introduction to the *vis viva* controversy.

[19] See Kant's 1747 text, *Gedanken von der wahren Schätzung der lebendigen Kräfte*.

[20] For most purposes these are equivalent expressions because our intuitions are sensible for Kant.

place of observations and related hypotheses in a theory, and the grounding principles of the science. Keeping the two separate is an implicit philosophical injunction by Kant against a Newtonian procedure of arguing inductively from phenomena.[21] We will have to consider this confrontation of methods in detail later on. But it should be noticed already that the description of the subject proper of natural science as matter *and* as the object of outer intuition cannot and does not avoid this thorny issue and should not be caricatured as the curiosity of a Kantian science as at once a pure rational as well as a sensationist account, but precisely as endeavouring to uphold those methodological desiderata we will need to inspect. Secondly, one may also correct the said false impression by noting that matter is not being taken only as something given to *perception* but that in calling matter an object of outer *intuition*, an essential relation to space is being indicated instead. Different aspects of this

[21] The reference is to Newton's so-called "Rules for the Study of Natural Philosophy" (Newton [1999], 794-796). These describe the inductive method of proceeding in "analogy with nature" and which supposedly behave as a priori principles without being hypotheses, of which Newton's "experimental philosophy" is famously disdainful. Kant gives his own dramatic version of the *hypotheses non fingo* in the *Critique of Pure Reason*: "[I]n this kind of inquiry… anything that even looks like an hypothesis is a forbidden commodity, which must not be put up for sale even at the lowest price but must be confiscated as soon as it is discovered." (Axv: "in dieser Art von Betrachtungen…alles, was darin einer Hypothese nur ähnlich sieht, verbotene Waare sei, die auch nicht für den geringsten Preis feil stehen darf, sondern, so bald sie entdeckt wird, beschlagen werden muß.") In the *Jäsche Logic*, he says: "There are sciences that do not permit of hypotheses, e.g., mathematics and metaphysics. But in physics they are useful and indispensable." (Kant [1988], 93; Ak.9:86: "Es giebt Wissenschaften, die keine Hypothesen erlauben, wie z.B. die Mathematik und Metaphysik. Aber in der Naturlehre sind sie nützlich und unentbehrlich.") Also, we ought to take Kant's *analogies of experience* as an improvement upon Newton's guidelines for reasoning in *analogy with nature*. Arguably, Kant endorses the truth of Newton's Rules and had implicitly relied on them in his own pre-critical work (e.g. in his 1763 essay on negative magnitudes, Kant uses something like Newton's Rules I and II to show from sameness of effect that the cause of impenetrability is a "true force" as are those exerted by springs; in his 1764 prize essay, Kant relies on something like Newton's Rule III to claim that if impenetrability as the expression of a force belongs to bodies, it does so to its elemental parts as well. (See Kant [1992], 218 & 260; Ak.2:179 & 2:287). But, with his *Metaphysical Foundations*, Kant wants to formulate a better and legitimate method for ascertaining their scientific status. This is an issue of indisputable significance and Kant's notion of matter as the object of outer intuition falls under this light. For a short account of the text and context of Newton's rules of philosophizing, see A. Koyre's "Newton's 'Regulae Philosophandi'" (pgs. 261-272 in Koyre [1965]); also see I. Bernard Cohen, Finocchiaro (1974), Norbert Hanson, Palter (1970), etc.

spatiality are mentioned by Kant e.g. in the *Critique of Pure Reason*, where matter is addressed as "reality in space" (B440), "the substance that appears in space" (A265/B321), and crucially, in the *Metaphysical Foundations*, we find a string of definitions organized around the concept of matter as the "movable in space" (e.g. MFNS 194, 209, 245, 260; Ak.4:480, 496, 536, 554).

(iii) *Empiricity*: The concept of matter relevant to the project is described as an empirical concept, an *an sich empirische Begriff* (MFNS 187; Ak.4:472). In the *Critique of Pure Reason*, its representational content is paradigmatically listed as "impenetrable lifeless extension," but neither the said empirical status of the concept nor the roster of its contents is always stable.[22] In such cases we will have to look to the context for easing out dissonances. Sometimes the concept seems bereft of any empirical determinations, e.g., Kant qualifies matter thus: "…the *real* in space (I cannot call it here impenetrability or weight, since these are empirical concepts)…"[23]

[22] The indecision over the empiricity or purity of the concept of matter leads to a complex of questions about the right with which Kant makes a priori assertions about it. For it seems natural to think that matter must be fitted in some way other than being a merely empirical representation in order to support the heavyweight a priori propositions about it in this text. In their examinations of this issue, Pollok (2006) and Friedman (2001) cite Peter Plaaβ and Michael Washburn as adherents of a view that takes matter to be an a priori concept that requires grounds to justify its objective reality by recourse to empirical intuition. Watkins (1995) clearly recounts the debate between Plaaβ and Karen Gloy, who both defend the concept of matter as a predicable and thus pure in content, but differ on the question of a need of proof for its objective reality. Watkins' own position(s) in this piece is quite remarkable: 1) his first argument charts a middle position between Plaaβ and Gloy and he upholds the *concept of matter as a predicable*, while showing that no such proof of objective reality is necessary; 2) his second argument to the same conclusion, namely, that no proof of the objective reality of the concept of matter is at issue in the *Metaphysical Foundations*, rests on his now upholding the *concept of matter as an empirical one*; 3) his final argument to the same effect points out that in fact it is matter itself that is at issue in the *Metaphysical Foundations* and thus *concepts of matter are altogether irrelevant* for the structure of the project. I examine this issue in detail in Chapter 2 and show this entire field of questions and interpretive strategies to be fundamentally misguided.

[23] A173/B215: "…das Reale im Raume (ich mag es hier nicht Undurchdringlichkeit oder Gewicht nennen, weil dieses empirische Begriffe sind)…"

But elsewhere, the concept of matter explicitly involves empirical characteristics like weight and impenetrability: "We take from experience nothing more than what is necessary to *give* ourselves an object… [of outer sense, which] is accomplished through the mere concept of matter (impenetrable lifeless extension)"[24]; "I do not at all include the predicate of weight in the concept of a body in general… But now I amplify my cognition and, looking back to the experience from which I had extracted this concept of body, I find that weight is also always connected with the previous marks [through which I analytically cognize the concept of body]…"[25]; "So if I separate from the representation of a body…that which belongs to sensation, such as impenetrability…"[26]; etc. And as a token of departure from the standard roster of contents, witness the following restrictions placed upon our cognition of this entity: "We know substance in space only through forces that are efficacious in it; whether in drawing others to it (attraction) or in preventing penetration of it (repulsion and impenetrability); we are not acquainted with other properties constituting the concept of the substance that appears in space and which we call matter."[27]

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[24] A848/B876: "[W]ir nehmen aus der Erfahrung nichts weiter, als was nöthig ist, uns ein Object [des äußeren Sinnes]… zu geben… [welches] geschieht durch den bloßen Begriff Materie (undurchdringliche leblose Ausdehnung)…"

[25] A8/B12: "Dagegen ob ich schon in dem Begriff eines Körpers überhaupt das Prädicat der Schwere gar nicht einschließe… Nun erweitere ich aber meine Erkenntniß, und indem ich auf die Erfahrung zurücksehe, von welcher ich diesen Begriff des Körpers abgezogen hatte, so finde ich mit obigen Merkmalen auch die Schwere jederzeit verknüpft…"

[26] A20-21/B35: "So, wenn ich von der Vorstellung eines Körpers das… was davon zur Empfindung gehört, als Undurchdringlichkeit…absondere…"

[27] A265/B321: "Die Substanz im Raum kennen wir nur durch Kräfte, die in demselben wirksam sind, entweder andere dahin zu treiben (Anziehung), oder vom Eindringen in ihn abzuhalten (Zurückstoßung und Undurchdringlichkeit); andere Eigenschaften kennen wir nicht, die den Begriff von der Substanz, die im Raum erscheint, und die wir Materie nennen, ausmachen."

Finally, there are, of course, well-known passages in the A-edition of the Paralogisms in the *Critique of Pure Reason* that talk of matter as only "a species of our representations." These passages were removed from the B-edition, presumably because they easily led to confusing Kant's transcendental idealism with Berkeley's idealism.[28] What is significant and interesting about these passages as we go along (especially at A384ff), however, is that in them Kant juxtaposes to the concept of matter that of motion, even though nothing is said about the analytic inclusion of the latter in the former.

The above statements show that the empirical nature of the concept of matter cannot be affirmed in any straightforward manner. Relatedly, we ought to remember that matter is an entity of special importance for the modern scientific conception, where it is presented as an abstract concept overlaid with several technical determinations. It is one thing to say that *matter* is an empirical concept in that it

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[28] Or at least with the position that James Van Cleve has called an ontological phenomenalism, which he describes as follows: "This doctrine [of transcendental idealism] is a variety of what we would nowadays call phenomenalism… There are two possibilities here that it is important to distinguish. On the one hand, objects may be *literally composed* of representations, as in Berkeley and Hume [such that objects just are patterns of representations]; on the other, they may be *logically constructed* from representations, as in Ayer and Lewis [such that statements about objects are logically equivalent to statements about representations]… I shall call the former doctrine *ontological* phenomenalism; the latter, *analytical* phenomenalism." (Van Cleve [1984], 43) Various statements in the A-Paralogisms suggest the former, e.g. "…matter (which is no thing in itself, but rather only a species of representations in us)… (A360: "…[die] Materie (die gar kein Ding an sich selbst, sondern nur eine Art Vorstellungen in uns ist)…"); "But now external objects (bodies) are merely appearances, hence also nothing other than a species of my representations, whose objects are something only through these representations, but are nothing separated from them." (A370: "Nun sind aber äußere Gegenstände (die Körper) blos Erscheinungen, mithin auch nichts anders als eine Art meiner Vorstellungen, deren Gegenstände nur durch diese Vorstellungen etwas sind, von ihnen abgesondert aber nichts sind."); "…the representations of matter and corporeal things; for these are merely appearances, i.e., mere modes of representation, which are always found only in us…" (A372: "…[die] Vorstellungen der Materie und körperlicher Dinge…denn diese sind lediglich Erscheinungen, d.i. bloße Vorstellungsarten, die sich jederzeit nur in uns befinden…"); "…the whole corporeal world… is nothing but the appearances in the sensibility of our subject and one mode of its representations" (A383: "…die ganze Körperwelt… als die nichts ist, als die Erscheinung in der Sinnlichkeit unseres Subjects und eine Art Vorstellungen desselben."), etc.

comes from reflecting upon ordinary outer experience, and quite another to say that it is a concept that does relate to objects of experience even as to its own origin but via extremely involved scientific speculation. For instance, in the *Metaphysical Foundations*, matter will be understood through various determinations of locomotion, a hallmark of the mechanical way of understanding the world, and not indiscriminately as the touchy, feely stuff of common experience. As such, then, "matter" refers not merely to a type of thing or a common empirical feature of things but to a set of problems constitutive for a field of research.[29]

C. *Motion*: This is the third of our fundamental concepts, which achieves somewhat unprecedented prominence in this text compared to the *Critique of Pure Reason*. Of course, to point to the indispensability of this concept for natural-scientific thought, whether Kant's or anyone else's, would be a severe understatement. But its particular role in the *Metaphysical Foundation* remains a matter of controversy. The following remarks may suffice to characterize this concept initially:

(i) <u>*Empirical Concept*</u>: The concept of motion is for the most part taken as empirically infected, although some texts permit thinking otherwise.[30] On account of

[29] Compare the sense in which Heidegger talks of the "problem of matter" in underscoring the self-critical moment of physics in relativity theory: "As a theory of the conditions under which we have access to Nature itself, it [relativity theory] seeks to preserve the changelessness of the laws of motion by ascertaining all relativities, and thus comes up against the question of the structure of its own given area of study [*die Struktur des ihr vorgegebenen Sachgebietes*]—the problem of matter." (Heidegger [1962], 30)

[30] An example of Kant talking about "motion" as a non-empirical concept may be set beside the several statements of the opposite view given in the main text above: "Among the categories, as original

motion presupposing some reference to the empirical, it is excluded from a "pure" science of any sort, and this partly explains its absence in the *Critique of Pure Reason* vis-à-vis its centrality in the *Metaphysical Foundations*. Consider the following: "[A]ll other concepts belonging to sensibility, even that of motion, which unites both elements [namely, space and time], presuppose something empirical. For this presupposes the perception of something movable…an empirical datum."[31] And: "[S]ince the *movability* of an object in space cannot be cognized a priori, and without instruction from experience, I could not, for precisely this reason, enumerate it under the pure concepts of the understanding in the *Critique of Pure Reason*…this concept, as empirical, could find a place only in a natural science, as applied metaphysics…"[32] Finally: "But there is much in it [universal natural science] that is not completely pure

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concepts of the understanding, are included also the predicables, as a priori concepts either of pure understanding, or sensorily conditioned, which arise from such compounding, and are thus derivative; the first of them yields existence considered as magnitude, i.e., duration, or change, as existence with opposite determinations; the second, the concept of motion, as change of position in space…" (from *What Real Progress Has Metaphysics Made in Germany since the Time of Leibniz and Wolff?* in Kant [2002], 364; Ak.20:272: "Noch gehören zu den Kategorien, als ursprünglichen Verstandesbegriffen, auch die Prädicabilien, als aus jener ihrer Zusammensetzung entspringende, und also abgeleitete, entweder reine Verstandes-, oder sinnlich bedingte Begriffe *a priori*, von deren ersteren das Daseyn als Größe vorgestellt, d.i. die Dauer, oder die Veränderung, als Daseyn mit entgegengesetzten Bestimmungen, von den andern der Begriff der Bewegung, als Veränderung des Ortes im Raume...") Also cf. Kant (1997), 457; Ak.29:988.

[31] A41/B58: "[A]lle andre zur Sinnlichkeit gehörige Begriffe, selbst der der Bewegung, welcher beide Stücke vereinigt, etwas Empirisches voraussetzen. Denn diese setzt die Wahrnehmung von etwas Beweglichem voraus." I will add, in a highly anticipatory, highly condensed, and highly reductive way, that this is a key text for the purposes of this dissertation: Kant cannot think the unity of space and time without appeal to experience even though he tries to produce a scheme for such a unity via acts of the transcendental imagination; although this text appears to say that it is the concept of motion itself which requires perception of the movable, the root issue is really one of perception supporting the abstract unification of spatial and temporal moments in motion; as we shall see in considering Hegel's philosophy of nature, Hegel can think a conceptual-dialectical unity of space and time in motion, which provides Kant with some way out of the several problems he encounters on this count.

[32] MFNS 195; Ak.4:482: "[D]a die Beweglichkeit eines Gegenstandes im Raum *a priori* und ohne Belehrung durch Erfahrung nicht erkannt werden kann, sie von mir eben darum in der Kritik der r.V. auch nicht unter die reine Verstandesbegriffe gezählt werden konnte, und daß dieser Begriff als empirisch nur in einer Naturwissenschaft als angewandter Metaphysik… Platz finden könne."

and independent of sources in experience, such as the concept of *motion*…among others, so that it cannot be called completely pure natural science."[33]

(ii) *"Various Senses" of Motion (VS)*: The concept itself merely indicates an alteration of place,[34] and the motion of a thing is more strictly defined by Kant as the "*change of its outer relations* to a given space."[35] An important text in the *Critique of Pure Reason* (which we shall henceforth refer to as the "VS" passage, as shorthand for "Various Senses") tells us more about other senses of motion that Kant can have in mind:[36]

> Motion, as action of the subject (not as determination of an object)*, consequently the synthesis of the manifold in space, if we abstract from this manifold in space and attend solely to the action by means of which we determine *inner sense* in accordance with its form, first produces the concept of succession at all.
> * Motion of an *object* in space does not belong in a pure science, thus also not in geometry; for that something is movable cannot be cognized a priori but only through experience. But motion, as *description* of a space, is a pure act of the successive synthesis of the manifold in outer intuition in general through productive imagination, and belongs not only to geometry but even to transcendental philosophy.[37]

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[33] Prol. §15; Kant (2002), 90; Ak.4:295: "Allein es ist doch auch manches in ihr, was nicht ganz rein und von Erfahrungsquellen unabhängig ist: als der Begriff der Bewegung…u.a.m., welche es verhindern, daß sie nicht ganz reine Naturwissenschaft heißen kann."

[34] E.g. A502/B530

[35] MFNS 196; Ak.4:482: "Erklärung 2: Bewegung eines Dinges ist die Veränderung der äußeren Verhältnisse desselben zu einem gegebenen Raum."

[36] Konstantin Pollok isolates three different registers of motion in this passage, naming them "transcendental" (motion as action of the subject), "geometrical" (motion as the description of space) and "objective" (motion as determination of the object) at Pollok (2006), 562. We will retain these names for convenience, even if they are jarringly imprecise and Pollok's analyses based on them appear unsatisfactory upon examination (see Section III.5 and f.n.45 of chapter 2 below).

[37] B154-5&n (translation modified): "Bewegung, als Handlung des Subjekts, (nicht als Bestimmung eines Objekts)* folglich die Synthesis des Mannigfaltigen im Raume, wenn wir von diesen

(iii)*"Programmatic Statement" about Motion (PS)*: Finally, let us take a look at Kant's claim concerning the concept of motion as it is asked to carry the weight of the task of the *Metaphysical Foundations*. This version of the concept draws a basic connection with the concepts of matter and of the object of outer sense. We shall refer to this as the "PS" passage, as shorthand for "Programmatic Statement": "The basic determination of something that is to be an object of the outer senses had to be motion, because only thereby can these senses be affected."[38]

II. Specific Imperatives of the *Metaphysical Foundations*

Do the several semantic variances noted in the first half of this chapter merely amount to terminological inconsistency on Kant's part, or even attest to the tentative nature of Kant's thought in regard to these terms? While the tentativeness cannot be denied, it would be premature to set about clearing up the whole issue by means of

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abstrahieren und bloβ auf die Handlung Acht haben, dadurch wir *den inneren Sinn* seiner Form gemäβ bestimmen, bringt so gar den Begriff der Sukzession zuerst hervor.
"*Bewegung eines Objects im Raume gehört nicht in eine reine Wissenschaft, folglich auch nicht in die Geometrie, weil, daß Etwas beweglich sei, nicht *a priori*, sondern nur durch Erfahrung erkannt werden kann. Aber Bewegung als Beschreibung eines Raumes ist ein reiner Actus der successiven Synthesis des Mannigfaltigen in der äußeren Anschauung überhaupt durch productive Einbildungskraft und gehört nicht allein zur Geometrie, sondern sogar zur Transscendentalphilosophie."

[38] MFNS 191; Ak.4:476: "Die Grundbestimmung eines Etwas, das ein Gegenstand äußerer Sinne sein soll, mußte Bewegung sein; denn dadurch allein können diese Sinne afficirt werden."

artificially imposing terminological accuracy upon Kant's text. It is obvious that the three terms focused on – nature, matter, motion – are central items in a text that purports to develop the principles of a science of *nature*, which is specified as a science of *matter* in general and ultimately presented as a doctrine of *motion*. Perhaps, then, getting hold of the main line of thought that runs through Kant's endeavor, which ties these concepts together in a specific way, should first illuminate the precise sense Kant intends for them. In the rest of the chapter I shall merely describe this line of thought; I will explore a set of problems arising from it in the next chapter, which will fix the senses of the key concepts.

The general project of Kant's book has been described above as a search for the principles of a natural science and this takes the form of spelling out the fundamental concepts and foundational structures of physics, comprising a priori cognitions about matter or body. By talking of "specific imperatives" I mean to flesh out the arguments adduced by Kant to specify the exact nature of the burden this implies. In a word, the general project resolves itself into the specific task of analyzing the concept of matter in relation to motion and in accordance with the table of categories. Kant arrives at this task by means of an extended argument in the Preface to the *Metaphysical Foundations*, which has two main steps: the first step tells us what the *criterion of the relevant natural science* is and the second step tells us *how this criterion is applied* to spell out the shape of the project. Accordingly, I describe below how 1) Kant develops a strict notion of what counts as natural science via an epistemic procedure he calls "construction of concepts" as a criterion for selecting among cognitions that can truly sustain that notion, and 2) he explains that the principles of such construction are to be sought via an analysis of the concept of matter, which eventually leads to certain propositions about motion.

II.1. *The Criterion of Natural Science*

In the first step, Kant works from a strictly delimited idea of a proper natural science. A science, for Kant, is in general a body of knowledge, a whole of cognitions whose parts are connected systematically. By a systematic connection Kant means that a principle of connection specifies the order of the parts in the whole beforehand. This principle is said to be rational when the connection is one of grounds and consequences, because the rational form as such essentially consists in such a connection, and accordingly a science of the type we are concerned with is a rational science if its form subscribes to such a principle. This means that as far as the form of a rational science is concerned, a science is a whole of cognition, whose parts are either grounds or consequences. Further, the connective principles may now be said to be either empirical or pure depending on whether the grounds are drawn from experience or conceived a priori. If a science has merely empirical grounds, then it will never be able to deliver the apodictic certainty of the cognitions contained in it or show the necessity of the connections between its parts, which Kant holds crucial to science properly speaking. Thus, any science properly speaking contains a "pure part."[39]

[39] MFNS 183-185; Ak.4:467-469.

Next, Kant determines the pure part of a proper science.[40] Since the science of interest here is a natural science, and *nature* is understood in terms of laws governing the determinations pertaining to the existence of a thing, the pure part in some sense must have to do with natural laws, and the purity claimed for this part implies that these are natural laws known a priori. For Kant, a priori knowledge is pure rational cognition and only possible in two ways: through metaphysics or through mathematics. The first is a cognition purely from concepts and the second is a cognition from the construction of concepts. Constructing a concept involves presenting the object of the concept in an intuition a priori. But since a natural science is directed at the laws determining the *existence* of a thing and existence involves intuiting a posteriori and excludes a priori intuition, a cognitive route through mathematical construction is closed for this science. This amounts to saying that a natural science properly speaking presupposes a metaphysics of nature, while the latter simply designates a priori knowledge of natural laws through concepts (and not by construction of concepts). But a metaphysics of nature, in turn, is possible in two ways:

> *first*, [it can] treat the laws that make possible the concept of a nature in general, even without relation to any determinate object of experience, and thus undetermined with respect to the nature of this or that thing in the sensible world, in which case it is the *transcendental* part of the metaphysics of nature; or *second*, [it can] concern itself with a particular nature of this or that kind of things, for which an empirical concept is given, but still in a manner that, outside of what lies in this concept, no other empirical principle is used for the cognition of things…[and] it is then not a general, but a *special* metaphysical

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[40] MFNS 185-186; Ak.4:469-471. This segment of Kant's argument is naturally very important because determining the pure part yields the veritable metaphysical principles of natural sciences, but Kant's reasoning is also very convoluted in this segment. In my exegesis I present an uncreased version of this story, while more pressing questions and problems will be laid out in the next section of my chapter.

> natural science (physics and psychology), in which the above transcendental principles are applied to the two species of objects of our senses.[41]

I will consider the architectonic negotiations Kant faces with this distinction between the general and special metaphysics of nature in Chapter 2, Section I. For now, we want to see how one arrives at *special* metaphysical principles. Kant asserts that a detour through mathematical principles is inevitable for laying hold of the special metaphysical principles. Metaphysical principles in general are a priori cognitions stemming from the concept of a thing alone, which disclose the possibility of that thing. But a special metaphysics implies a priori cognition of *determinate* natural things and thus implies that metaphysical cognition of the possibility of such things must somehow also be related to their given existence outside thought. Only intuitions can provide such a relation and so special metaphysical cognition demands that an intuition be given a priori corresponding to the concept of such a thing or, in other words, the said concept needs to be mathematically constructed.[42] Thus, interestingly, while the inapplicability of mathematical cognition first justified determining the pure part of a natural science in the form of metaphysical principles of nature, the special metaphysical principles themselves

[41] MFNS 185; 469-470 (translation modified): "…sie kann doch *entweder* sogar ohne Beziehung auf irgend ein bestimmtes Erfahrungsobject, mithin unbestimmt in Ansehung der Natur dieses oder jenes Dinges der Sinnenwelt von den Gesetzen, die den Begriff einer Natur überhaupt möglich machen, handeln, und alsdann ist es der transscendentale Theil der Metaphysik der Natur: *oder* sie beschäftigt sich mit einer besonderen Natur dieser oder jener Art Dinge, von denen ein empirischer Begriff gegeben ist, doch so, daß außer dem, was in diesem Begriffe liegt, kein anderes empirisches Princip zur Erkenntniß derselben gebraucht wird… aber es ist alsdann keine allgemeine, sondern besondere metaphysische Naturwissenschaft (Physik und Psychologie), in der jene transscendentale Principien auf die zwei Gattungen der Gegenstände unserer Sinne angewandt werden."

[42] The slide from *mere intuitions* to *a priori intuitions* as well as the related shift from *purely conceptual* metaphysical cognition to mathematical cognitions that include reference to *intuition* should be noted. These moves lie at the heart of the problems with Kant's project in this text.

are only within reach through the application of mathematical cognition, which now constitutes the criterion for any proper natural science.

> Hence, although a pure philosophy of nature in general, that is, that which investigates only what constitutes the concept of a nature in general, may indeed be possible even without mathematics, a pure doctrine of nature concerning *determinate* natural things…is only possible by means of mathematics. And, since in any doctrine of nature there is only as much proper science as there is a priori knowledge therein, a doctrine of nature will contain only as much proper science as there is mathematics capable of application therein.[43]

II.2. *Applying the Criterion*

In the second step of the overall argument of the *Preface*, the criterion of the applicability of mathematics is set to work in regard to the particular object of natural science, namely, matter or body. The extent to which that mathematical cognition is possible in regard to this object is just the extent to which metaphysical cognition is possible in this sphere. Kant makes a number of claims to flesh out this idea: 1) the relevant metaphysical cognition translates as the principles for the mathematical construction of the concept of matter; 2) the fundamental determination of the concept of matter in light of this search for special metaphysical principles is motion; 3) the plan of the science thereby projected follows the scheme of the table of categories and its

[43] MFNS 185-186; Ak.4:470: "Also mag zwar eine reine Philosophie der Natur überhaupt, d.i. diejenige, die nur das, was den Begriff einer Natur im Allgemeinen ausmacht, untersucht, auch ohne Mathematik möglich sein, aber eine reine Naturlehre über *bestimmte* Naturdinge… ist nur vermittelst der Mathematik möglich, und da in jeder Naturlehre nur so viel eigentliche Wissenschaft angetroffen wird, als sich darin Erkenntniß *a priori* befindet, so wird Naturlehre nur so viel eigentliche Wissenschaft enthalten, als Mathematik in ihr angewandt werden kann."

completeness is ensured therewith; 4) the criterion of mathematical application clarifies Kant's disqualification of psychology or other empirical sciences like chemistry as claimants to the title of proper natural science. I am not interested in (4) and leave it out of consideration. I also do not contest the completeness claim for the table of categories per se nor will I discuss the table's own inner configuration and my interest in (3) is restricted to the structure of the science projected by appealing to the table of categories. (1) and (2), however, are crucial to understanding the project of discovering the said metaphysical foundations.

According to (1), the criterion of mathematical applicability must be applied to the doctrine of body in order for the latter to count as a proper natural science. This means that the possibility of the object of the concept central to it, namely, matter, must be ascertained by mathematically constructing this concept, for which:

> [A] complete analysis of the concept of a matter in general will have to be taken as the basis, and this is a task for pure philosophy – which, for this purpose, makes use of no particular experiences, but only that which it finds in the isolated (although in itself empirical) concept itself, in relation to the pure intuitions in space and time (according to laws that already essentially attach to the concept of nature in general), and is therefore a genuine *metaphysics of corporeal nature*.[44]

[44] MFNS 187; Ak.4:472 (I have reintroduced Kant's own second set of parenthetical marks into Friedman's translation): "[E]ine vollständige Zergliederung des Begriffs von einer Materie überhaupt zum Grunde gelegt werden müssen, welches ein Geschäfte der reinen Philosophie ist, die zu dieser Absicht sich keiner besonderen Erfahrungen, sondern nur dessen, was sie im abgesonderten (obzwar an sich empirischen) Begriffe selbst antrifft, in Beziehung auf die reinen Anschauungen im Raume und der Zeit (nach Gesetzen, welche schon dem Begriffe der Natur überhaupt wesentlich anhängen) bedient, mithin eine wirkliche *Metaphysik der körperlichen Natur* ist."

The *Metaphysical Foundations* provides[45] just such an analysis of "the concept of matter in general". Although it is not specified precisely *how* we use the representations found in the empirical concept in relation to intuitions in space and time, the general shape of the task is apparent: to show the possibility of the concept of a determinate natural thing, we must provide a priori intuitions for the concept in question as the criterion of proper natural science requires. Since space and time are our only a priori intuitions, we need to arrange the representations of the complex content of that concept in relation to them, since pure intuitions in space and time equip us with principal elements of constructing concepts.

Next, Kant tells us how this procedure may legitimately aspire to completeness by being devised in accordance with the table of categories. We are told more than once that metaphysical cognition represents its object in terms of the principles of thought and these have been completely enumerated via the table of categories. Kant adds that other sciences (empirical sciences or mathematics) invoke an infinite field of intuitions (empirical or pure respectively) and hence countless objects for thinking, so there can never be completeness of cognition in their case.[46] This aspect of the argument also underlines the generality of the concept of matter under discussion. Notice that Kant has nowhere till now listed the elements of the concept of matter. This is because he believes that, by setting up the investigation according to the table of categories, *all* possible

[45] Thus, "pure philosophy" just is the entirety of the reflections contained in this work, not some other text, and the "task for pure philosophy" is carried out right here as Hansgeorg Hoppe tells us (Hoppe [1969], 58).

[46] MFNS 188; Ak.4: 473.

determinations of "the general concept of matter in general" will be accounted for, and so he does not need to presuppose any particular set of determinations for the concept:

> But the schema for completeness of a metaphysical system…is the table of categories. For there are no more pure concepts of the understanding which can be concerned with the nature of things. All determinations of the general concept of matter in general must be able to be brought under the four classes thereof… and so, too, must all that may be thought a priori about it, presented in mathematical construction, or given in experience as a determinate object thereof.[47]

The generality of the concept upheld for the argument so far is striking, especially when set against the wide semantic variance noted earlier (I.2.B). Kant intends his metaphysics of corporeal nature, then, to cover all possible cognitions about matter, or at least of the sorts he lists – a priori cognitions, mathematical constructions, empirical cognitions, etc. True, Kant's point is that this conception allows one to gather and organize information possible in this regard completely, but with the broadly conceived "general concept of matter in general," one seems to lose grip on the domain of the particular natural science concerned and the identity of its object seems to blur in the face of the diverse modes of knowing it. The next step of Kant's argument seems to be aware of this need to specify the determinations pertinent for the present project, given the alarming generality of the concept of matter just mentioned:

[47] MFNS 188-190; Ak.4:473-476 (translation modified): "Das Schema aber zur Vollständigkeit eines metaphysischen Systems…ist die Tafel der Kategorien. Denn mehr giebt es nicht reine Verstandesbegriffe, die die Natur der Dinge betreffen können. Unter die vier Classen derselben…müssen sich auch alle Bestimmungen des allgemeinen Begriffs einer Materie überhaupt, mithin auch alles, was *a priori* von ihr gedacht, was in der mathematischen Construction dargestellt, oder in der Erfahrung als bestimmter Gegenstand derselben gegeben werden mag, bringen lassen."

> The concept of matter had therefore to be carried through all four of the indicated functions of the concepts of the understanding (in four chapters), where in each a new determination of this concept was added. The basic determination of something that is to be an object of the outer senses had to be motion, because only thereby can these senses be affected. The understanding traces back all other predicates of matter belonging to its nature to this, and so natural science is either a pure or applied *doctrine of motion*. The *metaphysical* foundations of natural science are therefore to be brought under four chapters…[48]

Obviously, the claim that motion should be treated as the basic determination of matter since it is in some sense a condition of the affection of outer sense, invites much deeper reflection and we will take this up in Chapter 2, Section III. But the general direction of thought is clear in light of the foregoing. The application of the criterion of mathematical applicability has first shown us that a particular natural science of matter or corporeal being is indeed possible, and this requires an analysis of the concept of matter, whereby we search for those elements conducive to mathematical constructions and would then constitute the foundations of this science. Carrying out this analysis under the guidance of the table of categories assures us of having searched exhaustively and the analysis being complete, but the exhaustiveness comes at the cost of not being able to specify any determination as fundamental to the inquiry. The present passage now specifies just such a determination by means of the claim about motion and organizes the actual make-up of the various chapters of the book accordingly. Let this suffice as a description of the specific imperatives of the *Metaphysical Foundations*. The specific

[48] MFNS 191; Ak.4:476-477: "Der Begriff der Materie mußte daher durch alle vier genannte Functionen der Verstandesbegriffe (in vier Hauptstücken) durchgeführt werden, in deren jedem eine neue Bestimmung desselben hinzu kam. Die Grundbestimmung eines Etwas, das ein Gegenstand äußerer Sinne sein soll, mußte Bewegung sein; denn dadurch allein können diese Sinne afficirt werden. Auf diese führt auch der Verstand alle übrige Prädicate der Materie, die zu ihrer Natur gehören, zurück, und so ist die Naturwissenschaft durchgängig eine entweder reine oder angewandte *Bewegungslehre*. Die *metaphysischen* Anfangsgründe der Naturwissenschaft sind also unter vier Hauptstücke zu bringen…"

task at hand is to acquire the metaphysical foundations of a natural science, which is understood as a special metaphysics of corporeal nature, by means of a certain analysis of the isolated, empirical concept of matter, whose basic determination is taken as motion.

III. Which are the Metaphysical Principles?

Before proceeding to an analysis of particular obstacles facing the execution of this specific task (in my next chapter), I will briefly consider an issue that promises to confound all grasp of Kant's project in general. We have broached the sought principles of natural science from the perspective of their systemic status and considered Kant's prefatory statements about the impressive warrants they promise to natural science. But when we turn to the main text and its doctrinal content, simple questions like which are these principles and what they really assert, are not easily answered. This obviously threatens the whole project with futility. Even a passing glance reveals the tentative nature of Kant's actual pronouncements and just the bare fact that only one of sixteen propositions that come forward as principles is actually named a principle (*Grundsatz*)[49] gives a striking instance of the lack of fit between the scheme of the project and its actual

[49] Even this principle, in the Phoronomy chapter, is numbered as 1, as if in anticipation of more to follow. This slip can no doubt be attributed to the usual suspect, time constraints. Since the rest are called theorems (*Lehrsätze*) one can assume that they belong to that doctrine (*Lehre*) which now becomes proper science as it incorporates the metaphysical grounds being provided.

results.[50] Moreover, one does not find as much reference to the principles of the pure understanding of the *Critique of Pure Reason* as one would have liked in order to see their relation to the ones found here so as to unequivocally articulate the metaphysical sense of the latter.

Commentators have noticed this. Eric Watkins has raised objections against directly linking the principles of the *Metaphysical Foundations* to the transcendental principles of the *Critique of Pure Reason*.[51] According to him, reading the latter as assumptions for the former as well as simply substituting the object to which they apply (*matter* in place of the *object of experience in general*) yields textual inconsistencies. For instance, he correctly points out that substituting "matter" for "appearance" in the Second Analogy of Experience could presumably serve toward such desired derivation; but the result of such a substitution – "every change in matter has a cause" – does not yield the desired principle (expressed in the third proposition of the Mechanics chapter), which states, rather, that "every change in matter has an *external* cause."

Gerd Buchdahl registers a deeper complaint by showing not merely the inconsistencies in deriving the sought metaphysical principles from the transcendental

[50] Burkhard Tuschling's comments on this are entirely in order: "Kant's *Metaphysical Foundations* initially gives the impression of being a firmly established and systematically well-grounded theory and its central propositions are accordingly brought forward with a claim to apodictic certainty… All this stands opposed to Kant's modes of expression, whose methodical precaution, skepticism, and indeed uncertainty, speak against their own apparently apodictic claims… [T]he strict schematic form of the *Metaphysical Foundations*, which, on closer consideration, remains disproportionate to its content…" (Tuschling [1971], 34-37; my translation). Tuschling goes on to show that Kant's own later work rests on a radical re-assessment of the success of this earlier attempt: "In this discrepancy between claims and accomplishments, one must surely find powerful motivations for the fact that Kant struggled for long and not without desperation to save the *Metaphysical Foundations* as the basis for his further work, before eventually realizing that he must give it up. We shall see that he finally did take this unavoidable step." (ibid., 116, f.n.11; my translation)

[51] See Watkins (1998), esp. pgs 572-576 and 584-587.

principles, but that such a derivation is impossible in principle.[52] Taking a case in point, he argues that the Anticipations of Perception itself fails to hold as a principle in the way it is outlined and is thus in no position to do any further work of supporting derivative principles. The failure in question concerns the constitution of the intuition of determinate spaces through "successive synthesis," which provides the means to mathematize a given discourse. Buchdahl claims that while such a successive synthesis has legitimacy in respect of extensive magnitudes (i.e., for the Axioms of Intuition), it simply does not hold for intensive magnitudes, where the components to be synthesized are given instantaneously and not successively. This is a weighty objection, but it needs to be dissected so that we can isolate its region of impact exactly: 1) The Anticipations of Perception cannot function as principles of construction because their proper object is the instantaneous real immune to successive synthesis; 2) Kant does indeed undertake the construction of a concept of intensive magnitude (speed) in his Phoronomy chapter; 3) The Anticipations of Perception cannot lead to the metaphysical principles of Dynamics, which would be the corresponding result of a direct derivation according to the order of the table of categories (categories of Quality).

Now, I concur with (1) although I will return to this issue in Chapter 3, where we will find Kant himself battling problems of the sort Buchdahl mentions. But properly understanding (2) and (3) show how the *Metaphysical Foundations* is not susceptible to those charges and this qualifies the force of the objection in (1). First, *ad* (2): Kant admits that he is constructing a concept of intensive magnitude, but he emphasizes that its

[52] Cf. Buchdahl (1984).

procedure must be different from the one followed with extensive magnitudes.[53] The said difference, I think, consists in appealing to the geometrical rules of congruence to circumvent the problem of constructing the two types of quantity alike, and I will show both how this is at stake in his phoronomical analyses as well as how not just Buchdahl's but also Watkins' evaluation stems from misapprehending this point.[54] Second, *ad* (3): whatever Kant may have hoped and said about this, the Dynamics chapter does not in fact construct the concept of matter in accordance with the category of quality. It only re-affirms his remarks in the Anticipations of Perception that undercut the hypothesis of absolutely hard particles separated by voids, at the same time as they license his own hypothesis of a dynamical constitution of matter from fundamental forces, relinquishing voids as an explanatory component.[55] If this is right, then (2) and (3) do not pose the sort of problems for Kant's project as Buchdahl assumes. We can in any case retain the qualified result of his objection that it seems very difficult to draw a relation between the metaphysical principles of natural science and the principles of the pure understanding.[56]

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[53] MFNS 206; Ak.4: 493-494: "[T]he parts of speed are not external to one another like the parts of the space, and if the former is to be considered as a quantity, then the concept of its quantity, since this is *intensive*, must be constructed in a different way from that of the *extensive* quantity of space." ("[D]ie Theile der Geschwindigkeit sind nicht außerhalb einander, wie die Theile des Raumes, und wenn jene als Größe betrachtet werden soll, so muß der Begriff ihrer Größe, da sie *intensiv* ist, auf andere Art construirt werden, als der der *extensiven* Größe des Raumes.")

[54] See Chapter 2, Section III.3,4 and Chapter 3, Section I.3 – 5.

[55] Cf. MFNS 233-235; Ak.4: 523-525 and A173-175/B215-216.

[56] Before we leave his text, let me note another related misapprehension in Buchdahl's account. He observes of Kant's assertion that space and time are *continuous* quantities (which allows Kant to think of a successive synthesis of parts assigned to these quantities and to sensitive intensities that may be constituted in accordance with such quantities,) that it is contradicted by the hypotheses of quantum mechanics that show such Kantian assumptions about space and time as "not self-evident" and relegate them to the "field of empirical-theoretical facts" (Buchdahl [1984], 104-105). Now, although the Anticipations are indeed insecure with regard to their potential for a priori cognition, it is not on account of

Kenneth Westphal lands a telling objection against the connection of the metaphysical principles of natural science and the transcendental principles of the *Critique of Pure Reason* from the opposite angle. That is, while Buchdahl pointed out the mistake in drawing such a connection by arguing (about a particular case) that the transcendental principle in question is itself not a legitimate principle that could serve as a premise for deriving any other cognition, Westphal demonstrates (about a particular case) that a metaphysical principle asserted by Kant is itself only an empirical observation and thus, even if the transcendental principle in question be upheld,[57] talk of deriving the said metaphysical principle from it is mistaken. According to him, the purported metaphysical principle that "every change of matter has an *external* cause" is, in truth, merely an empirical observation. It rests upon my ignorance of a self-caused change in matter and of non-external determinations of matter, and does not possess the necessity a metaphysical principle claims.[58] Westphal removes the resources for a rejoinder along the lines of defending its metaphysical validity as a heuristic device or a regulative postulate, by recalling that the conditions of the analysis of matter in the *Metaphysical Foundations* strictly exclude any other empirical principles used in its cognition.

Kant's claims about space and time as continuous quantities, which do not contribute substantively to the argument here; this makes Buchdahl's worries irrelevant. The problems lie instead with Kant's insufficiently defended assertions about a "continuous nexus" (*kontinuierliche Zusammenhang*; A168/B210) that belongs to the real as an object of sensation in general. I expand on these issues in Ch.3.

[57] Westphal ([2004], ch.6) argues that even this is not the case and the transcendental principle that all events have a cause itself requires the metaphysical principle about external causality to be valid. According to his considered view, then, this problem and the gap it opens up at the heart of the *Critique of Pure Reason's* conceptual architecture is what informs the need for the *Metaphysical Foundations* itself.

[58] See Westphal 1995b.

Also, while the system of principles in the *Critique of Pure Reason* was explicitly developed from the table of categories,[59] it is hard to discern a parallel role for the categories in the production of the principles of natural science. Kant's closing remarks added to each chapter[60] of the *Metaphysical Foundations* do refer to the various categories as moments under whose gaze the discussion of the book is organized, but these remarks do not always perfectly map the categories onto the several principles actually set out in the text and generally retain a ring of hurried post facto explanations. So what exactly is the contribution of the categories to the sought metaphysical principles? For Kant, the table of categories is, among other things, a tool for envisioning the "scientific form of all cognitions of reason" (B109) and the following comment on its utility in this regard is especially pertinent:

> For that this table is uncommonly useful, indeed indispensable in the theoretical part of philosophy for completely outlining *the plan for the whole of a science* insofar as it rests on a priori concepts, and *dividing* it mathematically *in accordance with determinate principles*, is already self-evident from the fact that this table completely contains all the elementary concepts of the understanding, indeed even the form of a system of them in the human understanding, consequently that it gives instruction about all the *moments*, indeed of their *order*, of a planned speculative science, as I have elsewhere* given proof.

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[59] The principles of the pure understanding in the *Critique of Pure Reason* are "synthetic judgments that flow a priori from pure concepts of the understanding under these conditions [the sensible conditions of employing pure concepts, i.e., the schemata] and ground all other cognition a priori" (A136/B175: "…synthetischen Urtheilen, welche aus reinen Verstandesbegriffen unter diesen Bedingungen *a priori* herfließen und allen übrigen Erkenntnissen *a priori* zum Grunde liegen…"); "The table of categories gives us entirely natural direction for the table of principles, since these principles are nothing other than rules of the objective use of the categories." (A161/B200: "Die Tafel der Kategorien giebt uns die ganz natürliche Anweisung zur Tafel der Grundsätze, weil diese doch nichts anders, als Regeln des objectiven Gebrauchs der ersteren sind.")

[60] MFNS 207-8, 233, 258, 263-4; Ak.4:495, 523, 551, 558.

**Metaphysical Foundations of Natural Science*[61]

This statement, fresh with optimism deriving from the recently completed plan for the said science, suggests that the table of categories is here tested as a principle for ordering any scientific investigation. Thus, for Burkhard Tuschling, the entire book was written for the sake of such a proof or test: "Just this relation to the scheme of the categories and hence to the kernel of his critical philosophy is of interest to Kant…The *Metaphysical Foundations* was indeed written only for the sake of this test [*Probe*] and the proof that the categories are indispensable for the systematic grounding of a science, especially natural science, and not for communicating to the public the author's thoughts on a theory of matter, thoughts that are at the very least not unproblematic."[62] Eric Watkins echoes a similar sentiment in taking the table of categories as "the organizing principle of the science of nature".[63]

The discussion in this section has been mostly negative or at least deflationary, but it is important to see how. The problems stem from trying to understand the metaphysical principles of natural science as somehow deriving from the transcendental

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[61] B109-110&n.: "Denn daß diese Tafel im theoretischen Theile der Philosophie ungemein dienlich, ja unentbehrlich sei, *den Plan zum Ganzen einer Wissenschaft*, so fern sie auf Begriffen *a priori* beruht, vollständig zu entwerfen und sie systematisch *nach bestimmten Principien abzutheilen*: erhellt schon von selbst daraus, daß gedachte Tafel alle Elementarbegriffe des Verstandes vollständig, ja selbst die Form eines Systems derselben im menschlichen Verstande enthält, folglich auf alle *Momente* einer vorhabenden speculativen Wissenschaft, ja sogar ihre *Ordnung* Anweisung giebt, wie ich denn auch davon anderwärts* eine Probe gegeben habe.
"*Metaphys. Anfangsgr. der Naturwissensch."

[62] Tuschling (1971), 37-38; my translation.

[63] Watkins (1998), 575 f.n.24. In just this *organizational* sense, he is correct to hold that "the 'transcendental principles' [whose alleged application yields the metaphysical principles of natural science] are the categories (or the categorial headings), not the Principles of the Pure Understanding." (577 f.n.30)

principles of the pure understanding laid out in the *Critique of Pure Reason*. Consequently, we ought to reject this approach. I do not mean to say that these metaphysical principles have no relation to those transcendental principles at all, which would be untrue simply because the transcendental principles disclose the laws of nature as such and the particular realm of nature being considered in the *Metaphysical Foundations* cannot without absurdity be exempt from them. In fact, the issue here is one of examining the relations between particular doctrines of the *Critique of Pure Reason* and the *Metaphysical Foundations*, which must be conducted at the level of details as I will do in the following chapter.

Two aspects will stand out most clearly in this regard: 1) the problematic assumption of a general metaphysics of nature as such towards which the special metaphysics of nature draws, and 2) the particular arguments Kant needs in respect of what I have termed his "PS" claim, namely, that motion is the fundamental determination of matter. The first aspect will help clarify some misconceptions about the place of the *Metaphysical Foundations* in light of Kant's architectonic designs as well as refine our notion of analyticity in respect of both method and the promised "analysis" of the concept of matter. The second aspect will help reframe Kant's arguments by underscoring the need to attend to the conditions of possible experience as encapsulated in his theory of self-affection. Without reference to these two aspects and the argument I devise across them, it remains fundamentally obscure in what sense the principles offered in this text, which per se are principles of construction and hence mathematical, lay claim to a *metaphysical* status. We will then see that the *Anfangsgründe* of natural science, for Kant, are metaphysical to the extent that they involve an exposition of the possibility of

matter in general and depend on transcendental functions and capacities outlined in the *Critique of Pure Reason*.

Chapter 2

The Role of Motion in Understanding Matter

Having outlined in Chapter 1 the project of the *Metaphysical Foundations*, we now turn to certain problem-areas in need of further interpretation. We saw two sets of initial worries, one addressing the architectonic negotiations Kant must maneuver and the other addressing terminological variations that require stabilizing. We also saw that Kant's specific task lay in searching for the metaphysical principles of natural science, which culminated in the demand to provide the principles of constructing the concept of matter in terms of its basic determination, motion. In the interests of coherent exegesis I smoothed over several rough edges, but we should now hope to weave them into the fabric of the whole. In what I called the first step of Kant's overall argument in the Preface ("The Criterion of Natural Science"), the worries mainly attach to A) the manner of distinguishing between a general and a special metaphysics of nature and B) the nature of Kant's appeal to mathematical cognition as structuring the possibility of a proper *special* metaphysical science. In what I called the second step ("Applying the Criterion"), they concern C) the scope of the determinations of a "general concept of matter in general" and D) the restriction of this scope through the claim that asserts motion as the basic determination of matter.

I said that by highlighting the interconnections that string together Kant's main line of thought, we should be able to assuage these worries and this chapter seeks to make good that promise. I will argue that the inner thought running through the above set of

problems A-D involves Kant's treatment of the concept of matter through what I have called the "PS claim," which asserts that motion is the fundamental determination of something that is to be an object of outer sense. By means of this claim, Kant maintains that he can provide an exhaustive metaphysical analysis of matter as such. Yet, the PS claim stands obstinately unsupported by any other information about it and demands a philosophical interpretation to uncover its meaning. In this chapter, I provide such an interpretation by examining the aforesaid problem-sets in some detail. I find that they offer clues to unraveling the perplexing centrality of the PS claim and progressively determine its meaning.

Accordingly, In Section I ("Analytic Method and the Architectonic") I will take up problem-set-A regarding the relation of general and special metaphysics – and this section shows that the weight of Kant's architectonic worries fall upon the "instance *in concreto*" of the a priori analysis of matter. In Section II ("The Analysis of Matter") I will take up problem-set-C regarding the analyticity of Kant's method – and this section shows that the text presents two distinct concepts of matter and the analysis of matter only pertains to one of them. In Section III ("Motion and Mathematics"), I will jointly take up problem-sets-B and D concerning Kant's appeal to mathematical construction and the interpretation of the PS claim – and this section shows how and why the PS claim should be reconstructed as mediating between the two distinct concepts of matter so as to yield the definition of matter as movable, with which the doctrinal content of the *Metaphysical Foundations* actually begins.

I. Analytic Method and the Architectonic

Under this rubric, I intend to study the following question: how does the specific scientific discipline envisioned here by Kant fit into his larger architectonic view of all science? Answering this question amounts to knowing if and how the analytic method is being followed here, since the latter consists in discovering the conditions and principles of a proposition or state of affairs assumed as given or as true and the inquiry comes to a rest or the principles and conditions are considered found when they are identified or related to other principles of whose veracity we are already certain beforehand. The principles already secured are the principles of the pure understanding that Kant has elaborated under that name in the *Critique of Pure Reason*. Thus, let us try and understand the distinction made in the *Metaphysical Foundations* between general and special metaphysics in this context.

To begin with, recall the third chapter of Kant's transcendental doctrine of method in the *Critique of Pure Reason*, "The Architectonic of Pure Reason," where Kant tells us that the main division in metaphysics is between transcendental philosophy and the physiology of pure reason: "The former considers only the understanding and reason itself in a system of all concepts and principles that are related to objects in general without assuming objects that would be given (*Ontologia*); the latter considers nature, i.e., the sum total of given objects (whether they are given by the senses or, if one will, by another kind of intuition), and is therefore physiology (though only *rationalis*)."[1]

[1] A845/B873: "Die erstere betrachtet nur den Verstand und Vernunft selbst in einem System aller Begriffe und Grundsätze, die sich auf Gegenstände überhaupt beziehen, ohne Objecte anzunehmen, die *gegeben wären* (*Ontologia*); die zweite betrachtet *Natur*, d.i. den Inbegriff *gegebener* Gegenstände (sie

Physiology, in turn, divides according to whether the use of reason pertains to cognitions applicable in experience or not, thus as immanent or transcendent physiology. Immanent physiology itself is of two sorts according to the two types of its objects – a metaphysics of corporeal nature if the objects are those of outer sense (*physica rationalis*), and a metaphysics of thinking nature if the objects are those of inner sense (*psychologia rationalis*). This division of immanent physiology is recounted in the *Metaphysical Foundations* too, but there are two points of contrast between both expositions, one of them helpful (2) and the other not (1):

(1) The *Critique of Pure Reason* distinguishes between immanent and transcendent physiology (which both study nature), and between physiology (which studies nature) and ontology or transcendental philosophy (which does not study givens); whereas the division in the *Metaphysical Foundations* is between a general metaphysics of nature and a special metaphysics of nature (which therefore both study nature). The couple, 'general and special metaphysics of nature' seems to map onto the couple 'transcendental philosophy and physiology' as well as onto the couple 'transcendent and immanent physiology,' respectively in each case. Yet, these two mappings are incompatible with each other. So how do these various divisions line up?

(2) The division between rational physics and rational psychology in the *Metaphysical Foundations* is talked about in terms of two kinds of objects of our senses – inner and outer; whereas the same basis of the latter division is indicated in the *Critique of Pure Reason*, which says that immanent physiology considers its objects "in

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mögen nun den Sinnen, oder, wenn man will, einer andern Art von Anschauung gegeben sein), und ist also *Physiologie* (obgleich nur *rationalis*)."

accordance with the a priori conditions, under which it [nature, or the sum total of all that is given] can be given to us in general."[2] Since we divide the field of physiology in accordance with a priori conditions, and a priori conditions of givenness for us are explained in the transcendental aesthetic as twofold, namely the pure intuitions of space and time as the form of outer and inner senses, the division of immanent physiology is thus justified and can be carried over to the *Metaphysical Foundations*.

Thus, (2) helps understand the division of a special metaphysics of nature in a non-arbitrary way, but (1) creates difficulties while we still do not know where a general metaphysics of nature is supposed to figure according to the architectonic scheme. It is useful to remember that, although the system of principles of the pure understanding given in the *Critique of Pure Reason* would clearly help compose such a general metaphysics of nature, Kant simply has not written the latter. Yet, Kant does now and then indicate that such a general metaphysics of nature indeed exists, even with qualifications, referring to it as "pure natural science." e.g. in comments such as the following:

> Now we are nevertheless actually in possession of a pure natural science… Here I need call to witness only that propaedeutic to the theory of nature which, under the title of universal natural science, precedes all of physics (which is founded on empirical principles)… [But this "witness" is still inadequate on many counts, e.g. by involving empirical concepts like motion, impenetrability, inertia, etc., or by referring only to outer objects and not all objects generally.] But among the principles of this universal physics a few are found that actually have the universality we require, such as the proposition: *that substance remains* and persists, that *everything that happens* always previously *is determined by a*

[2] A846/B874: "Die immanente Physiologie betrachtet dagegen Natur als den Inbegriff aller Gegenstände der Sinne, mithin so wie sie *uns* gegeben ist, aber nur nach Bedingungen *a priori*, unter denen sie uns überhaupt gegeben werden kann."

> *cause* according to constant laws, and so on. These are truly universal laws of nature, that exist fully a priori. There is then in fact a pure natural science…[3]

So, the general metaphysics of nature seems to be a pure natural science whose existence is admitted even if in an incomplete form. In fact, if we take another look at Kant's architectonic chapter from the *Critique of Pure Reason*, we see why this must be the case. After explaining the various divisions of metaphysical cognition, Kant states the results by saying that "the entire system of metaphysics consists of four main parts: *1. Ontology. 2. Rational Physiology. 3. Rational Cosmology. 4. Rational Theology.* The second part, namely, the doctrine of nature of [i.e., per] pure reason, contains two divisions, *physica rationalis* and *psychologia rationalis*."[4] As being parts, they must naturally constitute special metaphysical disciplines. Now, we know that rational cosmology and rational theology are parts of a transcendent physiology, that is, they consider their objects beyond the conditions of possible experience and are disallowed by the critically astute metaphysician. Kant's criticisms of rational psychology in the

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[3] Prol. §15; Kant (2002), 89-90; Ak.4:294-295: "Nun sind wir gleichwohl wirklich im Besitze einer reinen Naturwissenschaft, die *a priori* und mit aller derjenigen Nothwendigkeit, welche zu apodiktischen Sätzen erforderlich ist, Gesetze vorträgt, unter denen die Natur steht. Ich darf hier nur diejenige Propädeutik der Naturlehre, die unter dem Titel der allgemeinen Naturwissenschaft vor aller Physik (die auf empirische Principien gegründet ist) vorhergeht, zum Zeugen rufen… Es finden sich aber unter den Grundsätzen jener allgemeinen Physik etliche, die wirklich die Allgemeinheit haben, die wir verlangen, als der Satz: *daß die Substanz bleibt* und beharrt, *daß alles, was geschieht, jederzeit durch eine Ursache* nach beständigen Gesetzen vorher *bestimmt sei*, u.s.w. Diese sind wirklich allgemeine Naturgesetze, die völlig *a priori* bestehen. Es giebt also in der That eine reine Naturwissenschaft…" Ernan McMullin identifies the "witness" that Kant summons with "the science defined by the axiomatic opening sections of the [Newton's] *Principia*" (McMullin [2001], 305). Also, see a similar assertion at B20 and the footnote on B21, though care must be taken there to distinguish Kant's reference to *physica pura* or *physica rationalis* or (as Kant also points out at A847/B875 f.n.) *physica generalis* from "pure natural science."

[4] A846-847/B874-875: "Demnach besteht das ganze System der Metaphysik aus vier Haupttheilen: *1. Der Ontologie. 2. Der rationalen Physiologie. 3. Der rationalen Kosmologie. 4. Der rationalen Theologie*. Der zweite Theil, nämlich die Naturlehre der reinen Vernunft, enthält zwei Abtheilungen, die *physica rationalis* und *psychologia rationalis*."

Paralogisms too are well known, which nullify any prospects for this alleged science. That leaves, besides rational physics, only ontology as a contender for the title of a special metaphysical science.

The defining characteristic of ontology, as we saw, was that it considered the system of rational concepts "related to objects in general [*Gegenstände überhaupt*] without assuming objects that *would be given* [*Objekte…die* gegeben wären]." Described this way, ontology would also be rejected by the critically trained metaphysician because the *Critique of Pure Reason* teaches that it is impossible to have a priori cognition without appeal to a possible experience, where alone objects are given to us. A critically alert metaphysics allows a priori cognition through pure concepts of the understanding so far as they are applied to objects that can be given in experience, but forbids their application to objects *in general*.[5] Thus, Kant had declared that "the proud name of an ontology, which presumes to offer synthetic a priori cognitions of *things in general*…must give way to the modest one of a mere analytic of the pure understanding."[6]

[5] The tortured Kantian qualification "without assuming objects that would be given" serves to highlight that the target of this expression is the Wolffian metaphysician, according to whom ontology studies *possibles*, which are the type of objects answering to the given expression, while the sciences of cosmology, theology, and psychology study *actuals*. Kant rearranges these same alleged sciences in accordance with his own architectonic and hence his language echoes the Wolffian vocabulary. In place of the Wolffian distinction between *possible* and *actual* as initial points of metaphysical inquiry, Kant begins with the distinction between *that which is* and *that which should be* (A840/B868) and tries to rehabilitate the speculatively illegitimate sciences such as theology and psychology from a practical point of view. Much can and ought to be said about these disciplinary strategies, but that would be another story.

[6] A247/B303 (my italics): "…der stolze Name einer Ontologie, welche sich anmaßt, von Dingen überhaupt synthetische Erkenntnisse *a priori* in einer systematischen Doctrin zu geben (z.E. den Grundsatz der Causalität), muß dem bescheidenen einer bloßen Analytik des reinen Verstandes Platz machen."

Where does this leave us? Except for the one science of a rational physics, Kant has struck off all the other candidates for the title of special metaphysics from his list. Now, if all special metaphysical disciplines but for one appear unviable, then this also means that the "general metaphysics of nature" is just an empty class or at least viewed problematically. A general metaphysics of nature, which would treat its object as undifferentiated in respect of the division of the senses, is thus either admitted with qualifications under the rubric "pure natural science" as we saw in the passage from the *Prolegomena*, or it is viewed problematically when a critical perspective is trained onto the architectonic divisions of the metaphysical system. Conversely, the need to work out the special metaphysics of natural science by investigating the possibility of a rational physics, as undertaken in the *Metaphysical Foundations*, becomes even greater. *This* is the context of Kant's remarks about the "remarkable" value of the investigation into the metaphysics of body in the Preface to the *Metaphysical Foundations*:

> It is also indeed very remarkable […] that general metaphysics, in all instances where it requires examples (intuitions) in order to provide meaning for its pure concepts of the understanding, must always take them from the general doctrine of body, and thus from the form and principles of outer intuition; and, if these are not exhibited completely, it gropes uncertainly and unsteadily among meaningless concepts… And so a separated metaphysics of corporeal nature does excellent and indispensable service for *general* metaphysics, in that the former furnishes examples (instances *in concreto*) in which to realize the concepts and propositions of the latter (properly speaking, transcendental philosophy), that is, to give a mere form of thought sense and meaning.[7]

[7] MFNS 192; Ak.4:478: "Es ist auch in der Tat sehr merkwürdig…daß die allgemeine Metaphysik in allen Fällen, wo sie Beispiele (Anschauungen) bedarf, um ihren reinen Verstandesbegriffen Bedeutung zu verschaffen, diese jederzeit aus der allgemeinen Körperlehre, mithin von der Form und den Principien der äußeren Anschauung hernehmen müsse und, wenn diese nicht vollendet darliegen, unter lauter sinnleeren Begriffen unstät und schwankend herumtappe... Und so tut eine abgesonderte Metaphysik der körperlichen Natur der *allgemeinen* vortreffliche und unentbehrliche Dienste, indem sie Beispiele (Fälle in *Concreto*) herbeischafft, die Begriffe und Lehrsätze der letzteren (eigentlich derTranszendentalphilosophie) zu realisiren, d.i. einer bloßen Gedankenform Sinn und Bedeutung unterzulegen."

Similarly, Kant says in the General Remark appended to the system of principles of pure understanding in the second edition of the *Critique of Pure Reason*: "It is even more remarkable, however, that in order to understand the possibility of things in accordance with the categories, and thus to establish the *objective reality* of the latter, we do not merely need intuitions, but always *outer intuitions*."[8] Misapprehending the context for these statements leads to a deep-seated confusion about the nature of Kant's appeal to a doctrine of body or the concept of matter and the significance of outer intuitions for transcendental philosophy. One can mistakenly believe that Kant here indicates that the problem of metaphysical cognition as such (the possibility of synthetic a priori cognition and the proof of the objective reality of the pure concepts of the understanding) is solved by taking the *Metaphysical Foundations* as articulating the conditions of metaphysical cognition through the concept of matter. This eventually leads to questions about proving the objective reality of the empirical concept of matter as an a priori condition of experience as I mentioned earlier,[9] which is at least hard to understand as a problem if not outright nonsensical. Thus, the correct interpretation of these statements shows that Kant merely observes that a general metaphysics of nature, which is a somewhat problematic

[8] B291: "Noch merkwürdiger aber ist, daß wir, um die Möglichkeit der Dinge zu Folge der Kategorien zu verstehen und also die objective Realität der letzteren darzuthun, nicht bloß Anschauungen, sondern sogar immer äußere Anschauungen bedürfen."

[9] See my Ch.1, f.n.22. Michael Friedman's repeated appeals to the passages quoted above are thus misplaced and do not provide the sort of support he expects for his interpretation. I show below that correctly apprehending this context not only helps understand the architectonic positioning of the project of the *Metaphysical Foundations* but also sheds light on the problem of the empiricity of the concept of matter. Also, see Edwards (2004), 174-175f.n 46, for a similar point, although the remarks there are directed against Eckart Förster's interpretation of these passages.

concept, acquires genuine significance only in regard to the special metaphysics of nature as elaborated in the *Metaphysical Foundations*, and that the recourse to outer intuitions as stressed in the latter text does not amount to any redundant feat of transcendental deduction, but only serves to guard the genuine special metaphysics from uncritically straying into the indeterminate regions of an ontology in the (bad) older sense of the term.[10]

Does this inform us about the analytic method employed in the *Metaphysical Foundations*? Clearly, no conclusive connections can be drawn between the principles of constructing the concept of matter and the laws of nature belonging to the transcendental part of the metaphysics of nature so long as the relation between special and general natural metaphysics is not elucidated unambiguously. Kant may have reasons for not writing the general metaphysics of nature, but so long as it is unwritten we can only surmise how a special metaphysics is related to it. But this means that we cannot synthetically derive special metaphysics from a general one and it is in this sense that the analytic method of the *Metaphysical Foundations* is necessary – we must start from the bottom up and proceed tentatively towards determining the relation between a special and

[10] My interpretation of the relation between Kant's appeals to the doctrine of body on behalf of a special metaphysics and the vacuity of general metaphysics thus comes close to Hansgeorg Hoppe's position. He says about the above-cited "General Remark to the System of Principles" from the *Critique of Pure Reason* (KRV) and the corresponding passage from the *Metaphysical Foundations* (MAGr): "The General Remark, thus, does not contain the still more closely executed attempt (in the KRV as well as the MAGr) to produce the realization of the categories and proofs of principles with the help of outer intuitions apart from and instead of the means given through the schematism related to time… Correspondingly, even here in the MAGr, one is not concerned with the realization of the concepts and principles, whose objective reality is already shown in the schematism-chapter and in the proof of the principles, thus [one is concerned] not with the realization of the critical ontology or of the transcendental part of the metaphysics of nature, rather another way to realize the general uncritical metaphysics though the relation of its concepts to outer intuitions." (Hoppe [1969], 41; my translation; also see ibid., 30-35)

a general metaphysics of nature.[11] This also means that we need to finesse our notion of an "instance *in concreto*" as a major structural requirement of the project, and I will try to argue in the next section that this requires us to re-think the nature of Kant's appeal to the *empirical* concept of matter.

II. The Analysis of Matter

Next, let us take up the problem of the empiricity of the concept of matter. Here, I am still concerned with the problem of determining a special metaphysics of nature and the interpretation that this ought to be done by assuming the determinate natural thing as given through the empirical concept of matter. As noted, the empiricity of this concept has given rise to a number of questions, which all may be besides the point if this empiricity does not play as large a role as the premises of those questions assume. On the other hand, I have already stressed the need to come to terms with Kant's intriguing

[11] This indeed leaves questions about the relation of special and general metaphysical principles open, which one is tempted to answer by looking for resources in Kant's doctrine of the regulative employment of reason or the theory of reflective judgment, which appear to work in the vicinity of such concerns. But these theories are occupied with determining the inter-relation of empirical principles, i.e., a posteriori ones, and not metaphysical or a priori ones. Therefore, I part ways with interpretations of the *Metaphysical Foundations* and the *Critique of the Power of Judgment* where both are similarly conceived Kantian attempts to deal with the question of empirical cognition. The fact that the former takes matter as an empirical but *isolated* concept should already alert us to the difference in Kant's procedure in the latter text, which takes issue with a *network* of empirical concepts. True, the problems with the *Metaphysical Foundations* may well have spurred Kant on to investigate the theoretical basis of the connection of empirical propositions – we may read the later Kant as generalizing a particular problem of the earlier Kant, namely, that of finding grounds for subsuming other empirical predicates of matter under the basic but empirical predication of it through motion – but that does not mean that the earlier Kant is reducible to the later one. On the more or less explicit connections between the two texts, see Kant's remarks on conducting investigations in the mixed field of a priori and a posteriori principles at the start of §X of the unpublished "First Introduction" to the *Critique of the Power of Judgment* (Kant [2000], 37-38; Ak.20: 237) and of §V of the published Introduction (ibid. 68-69; Ak.5:181-182).

expression "general concept of matter in general" instead of rummaging through the representational contents of one or the other empirical concept of matter. In addition, precisely explaining the role of the empiricity of this concept provides further clarifications about the analytic procedure because, as mentioned earlier, Kant's talk about the analysis [*Zergliederung*] of the concept of matter also motivated description of the method of the *Metaphysical Foundations* as analytic.[12] What makes us think that Kant is inviting us to analyze the concept of matter in the sense of rummaging through the empirical representations constituting its intension? We have already encountered the relevant passages but let us look at them more closely now:

> [Special metaphysics treats of determinate natural things] for which an empirical concept is given, but still in such a manner that, outside of what lies in this concept, no other empirical principle is used for the cognition of things (for example, it takes the empirical concept of matter or of a thinking being as its basis, and it seeks that sphere of cognition of which reason is capable a priori concerning these objects)…[13]
> [A] complete *analysis of the concept of a matter in general* will have to be taken as the basis…which, for this purpose, makes use of no particular experiences, but only that which it finds in the isolated (although intrinsically empirical) concept itself…[14]

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[12] This sort of view appears, e.g., in Edwards (2000), 5: "Kant's metaphysics of nature [proceeds…] by means of the 'complete *analysis* of the concept of matter in general.' This *analytic* procedure generates the system of principles at issue…" (my italics). Later, Edwards avoids ambiguity by finessing the translation and paraphrasing: "[Kant's] explanation is provided by means of the 'complete *articulation* (*Zergliederung*) of the concept of matter in general'…" and Kant's procedure is now called "his metaphysically *expository* procedure" (Edwards [2004], 166; my italics).

[13] MFNS 185; Ak.4:470: "…sie beschäftigt sich mit einer besonderen Natur dieser oder jener Art Dinge, von denen ein empirischer Begriff gegeben ist, doch so, daß außer dem, was in diesem Begriffe liegt, kein anderes empirisches Princip zur Erkenntniß derselben gebraucht wird (z.B. sie legt den empirischen Begriff einer Materie, oder eines denkenden Wesens zum Grunde und sucht den Umfang der Erkenntniß, deren die Vernunft über diese Gegenstände *a priori* fähig ist)…"

[14] MFNS 187; Ak.4:472 (my italics): "…mithin wird eine vollständige Zergliederung des Begriffs von einer Materie überhaupt zum Grunde gelegt werden müssen… die zu dieser Absicht sich keiner besonderen Erfahrungen, sondern nur dessen, was sie im abgesonderten (obzwar an sich empirischen) Begriffe selbst antrifft…"

These passages appear to license inquiry into "what lies in" or "is found in" the empirical concept of matter, even though we see Kant talking of the concept of a matter *in general* as the basis of his theory. Kant is silent not just on the issue of *what* lies in the empirical concept of matter but also *how* one is to make use of that content. Kant describes the process of setting up the special metaphysics of corporeal nature in the *Critique of Pure Reason* as well, with the help of which we may perhaps coax the above taciturn passages to say more. There, Kant describes the project with a glance towards precisely the sort of concern that animates questions about the empiricity of matter and its ability to support a priori cognition. Kant asks:

> [H]ow can I expect an a priori cognition and thus a metaphysics of objects that *are* given to our senses, thus given a posteriori? And how is it possible to cognize the nature of things in accordance with a priori principles and to arrive at a *rational* physiology? The answer is: We take from experience nothing more than what is necessary to *give* ourselves an object, partly of outer and partly of inner sense. The former is accomplished through the mere concept of matter (impenetrable lifeless extension), the latter through the concept of a thinking being (in the empirically inner representation 'I think'). Otherwise, we must in the entire metaphysics of these objects abstain entirely from any empirical principles that might add any sort of experience beyond the concept in order to judge something about these objects.[15]

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[15] A847-8/B875-6: "[W]ie kann ich eine Erkenntniß *a priori*, mithin Metaphysik von Gegenständen erwarten, so fern sie unseren Sinnen, mithin *a posteriori* gegeben sind? und wie ist es möglich, nach Principien *a priori* die Natur der Dinge zu erkennen und zu einer *rationalen* Physiologie zu gelangen? Die Antwort ist: wir nehmen aus der Erfahrung nichts weiter, als was nöthig ist, uns ein Object theils des äußeren, theils des inneren Sinnes zu geben. Jenes geschieht durch den bloßen Begriff Materie (undurchdringliche leblose Ausdehnung), dieses durch den Begriff eines denkenden Wesens (in der empirischen inneren Vorstellung: Ich denke). Übrigens müßten wir in der ganzen Metaphysik dieser Gegenstände uns aller empirischen Principien gänzlich enthalten, die über den Begriff noch irgend eine Erfahrung hinzusetzen möchten, um etwas über diese Gegenstände daraus zu urtheilen."

Since not concepts but intuitions are that whereby objects are *given* to us, Kant parenthetically mentions the relevant empirical intuitions that may yield the empirical concepts of matter and thinking things. In order to get a sense of the complications underlying the empiricity of the concept of matter under discussion here, let us briefly study the analogous case of the empirical concept of the thinking thing. This indirect analysis should both caution us against any simple uptake of the empirical concept of matter as well as underscore by contrast the need to attend to the significance of Kant's talk of the "general concept of matter in general."

How is the concept of the thinking thing related to the empirical inner representation 'I think'? Through introspection, I find this representation common to my various empirical apperceptions, from which I can procure the empirical concept 'I think.' This empirical concept or proposition immediately asserts the existence of *a* thinking thing (only myself),[16] just as Descartes maintained in his second *Meditation*. So, one might say that the object of the concept of a thinking thing is immediately beheld through empirical apperception. But, if Kant's passage before us does say this, then the analogy between this and apprehending matter breaks down because the enviable property of disclosing the existence of an object through its mere concept seems peculiar to the 'I think' and it certainly is not a property of the concept of matter.

On the other hand, perhaps things are not so simple even with the empirical representation 'I think.' Kant cautions against the scope of the proposition and the

[16] Descartes (1984), 17-19. Also see Descartes' replies to Mersenne's and Hobbes' objections (ibid., p. 100 and 122-124 respectively). While Descartes clearly insists on the existence of the singular subject indicated through radical doubt, it may still be said that this singularity is not restricted to the "personal concrete self" and signifies abstract universality both in virtue of the order of the argument at this point as well in view of suspending talk of individuation of particular substances in this text (Cf. Gueroult [1984], vol.1, 30-34, 288n.8 & 63-74).

inferences drawn from it in the B-edition of the Paralogisms in the *Critique of Pure Reason*. He points out that my existence is immediately contained in the empirical representation 'I think,' and that I am not inferring my existence qua thinking thing as such via a syllogism whose major premise would assert that all thinking things exist.[17] According to Kant, I only ought to say that "I exist thinking," which merely means "the determinability of my existence in regard to my representations in time."[18] But, as the story goes, the empirical representation 'I think' itself cannot help actually determine my existence and we need an intuition of something persistent in addition. Without the latter, the empirical representation 'I think' expresses

> an indeterminate empirical intuition, i.e., a perception… but it precedes the experience that is to determine the object of perception through the category in regard to time; and here existence is not yet a category, which is not related to an indeterminately given object, but rather to *an object of which one has a concept, and about which one wants to know whether or not it is posited outside this concept*. An indeterminate perception here signifies *only something real, which was given, and indeed only to thinking in general, thus not as appearance, and also not as a thing in itself (a noumenon)*, but rather as

[17] I am not sure I follow Kant's reasoning here. Descartes denied that he is using a syllogism to infer the ego's existence from the cogito simply because he does not have insight into a universal proposition such as "all thinking things exist" (cf. f.n.16). Kant, on the other hand, thinks that such a proposition is inherently problematic because it asserts the absolutely necessary existence of thinking beings (cf. B420, B422 f.n.). That is, he understands the proposition that would serve as a major premise in the abovementioned syllogism as asserting "there necessarily exist thinking things" instead of merely saying "necessarily, if any thing thinks, it exists." I cannot understand how he reads the former into the latter (and this confusion of the senses of necessity would not be odd in Kant according to Paul Guyer, who reads Kant's claims about the apriority of space and time and the doctrine of transcendental idealism as resting almost entirely on such a confusion), but his point about the limited scope of the existential claim made through the 'I think' is clear enough and may still be upheld on the basis of something like the ignorance of the claim's universality.

[18] B420: "…ich existire denkend, so ist er [der Satz, "Ich denke"] empirisch und enthält die Bestimmbarkeit meines Daseins bloß in Ansehung meiner Vorstellungen in der Zeit."

> something that in fact exists and is indicated as an existing thing in the proposition 'I think'.[19]

For our present purposes, we can forego exploring the way of being of "something real" that "in fact exists", but is neither an appearance nor a thing in itself, and is "given" but only to "thinking in general". I merely mean to gesture toward the thicket of difficulties facing any interpretation of the concept of the thinking thing as giving one the object of the special metaphysics that may have been erected upon the foundation of the empirical intuition related to that concept. Again, if an analogy is intended between the way in which this empirical concept yields the object-domain of a special metaphysics (rational psychology) and the empirical concept of matter its object domain (rational physics), things simply do not bode well for grasping the latter in ways parallel to the former. By contrast, the safest way to understand how the empirical concept of matter may *give* us the object of the special metaphysical science in question is to take this expression as articulating an *assumption* that there exists matter, whatever it may be.

If we now consider the "general concept of matter in general" in relation to such an assumption, it becomes clearer what propels Kant's thought here. Recall how Kant wields this concept: with it, he intends to capture all determinations of this *concept* in the pure web of the categories (or at least the four classes of the functions of judging).

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[19] B422-423 f.n. (italics mine): "…eine unbestimmte empirische Anschauung, d.i. Wahrnehmung… geht aber vor der Erfahrung vorher, die das Object der Wahrnehmung durch die Kategorie in Ansehung der Zeit bestimmen soll; und die Existenz ist hier noch keine Kategorie, als welche nicht auf ein unbestimmt gegebenes Object, sondern nur ein solches, davon man einen Begriff hat, und wovon man wissen will, ob es auch außer diesem Begriffe gesetzt sei, oder nicht, Beziehung hat. Eine unbestimmte Wahrnehmung bedeutet hier nur etwas Reales, das gegeben worden und zwar nur zum Denken überhaupt, also nicht als Erscheinung, auch nicht als Sache an sich selbst (Noumenon), sondern als Etwas, was in der That existirt und in dem Satze: Ich denke, als ein solches bezeichnet wird."

Obviously, this will only yield conceptual determinations and we would still want to know about their objective reality. Naturally just this motivates appeals to the *empirical* concept of matter, whose objective reality is already certified by virtue of acquiring this concept from experience. But we have just seen reasons to be careful in taking an analysis of the latter concept as structuring Kant's project, beyond the mere assumption that such a thing exists. So, we have greater reason to understand Kant's project in terms of the analysis of the *general* concept of matter as such. Thus, Kant wants to analyze *this* concept for the purposes of supplying the principles governing the application of mathematics to a doctrine of body. As he says, the said principles would show how to construct certain concepts that "belong to the possibility of matter *in general.*" (MFNS Ak.4:472; my emphasis.)

Now, the existence-assumption articulated through the empirical concept of matter helps us understand the possibility of matter that is under discussion. Assuming as given that there is something called matter, we can legitimately ask after its possibility *as an object of experience*.[20] That is, we are not required to prove the real possibility of the object of this concept for the first time, but directly infer its possibility from its actuality. But at the same time we cannot make the empirical representation the basis of our a priori cognitions about matter, which is presumably what explicating its possibility means. That is, while from experience we may have learnt that something like matter is possible because it is actual, we still do not know the universal and necessary conditions of the

[20] Thus there is *some* truth to reading the *Metaphysical Foundations* as an inquiry into the conditions of possibility of outer experience. This sort of approach is preferred by Eric Watkins, and I will evaluate the truth of such an approach in section III.4 below. Specifically, I reject the establishment of analytic arguments *solely and wholly from* the fact of outer experience as a point of departure.

possibility of matter as such. Since the categories, qua necessary forms of predication of any objectivity, contain a scheme for disclosing the metaphysical possibility of a thing, the explication of matter's universal conditions of possibility proceeds according to them.

III. Motion and Mathematics

All together, we see from the above that (1) the methodological question of analyticity contains two distinct considerations: (1a) the necessity of Kant's bottom-up manner of inquiry – if there is *any* metaphysics of nature properly speaking, we must start from the *assumption* of a particular natural science; and (1b) the said analysis of the concept of matter involves an explication of the possibility of matter with reference to the general concept of matter in general, and further, indicates a not yet explicated relation to the *assumption* of the existence of matter via its ordinary empirical representation. We also possess (2) the negative but useful result that we need not speculate about the semantics of the empirical concept of matter for Kant, as if that would hand over to us the key to Kant's argument. As far as (1a) is concerned, this is a familiar promissory refrain in Kant's works as they proceed under the sign of a problematic conception of a systematic metaphysics – I shall leave this aspect alone until much later. There, I will comment on the weight of Kant's conditionals falling upon the being of nature itself – and this will reflect the tension noted in the first chapter between the formal and the material senses of nature that Kant is trying to correlate, the formal constitution of what exists on the one hand and the factual givenness of all that exists.

Immediately pressing upon us for the purpose of unraveling the structure of Kant's present project is the relation of the two representations of matter that have come to light in (1b) – the general and the empirical concepts of matter. If we now look back to the terminological variances noted earlier (Ch.1, sections I.2.B (ii) & (iii)), we are able to make a selection. In the first instance, the general concept of matter would indicate the *real in space* and the empirical concept of matter indicates *objects of outer sense*. Given this distinction and the restriction in (2) above excluding appeal to the empirical contents of our everyday concept of materiality, *that* Kant intends a relation between the two becomes clearer if we attend to his formulation of the role of motion in what we termed Kant's "Programmatic Statement" (MFNS 191; Ak.4:476-477; we will refer to this as "PS"). According to this, the predicates of matter explicated in accordance with the table of categories must be led back to motion, since motion is the fundamental determination of "what is to be the object of outer senses." Clearly, the concept of motion begins to specify the relation between the general and empirical concepts of matter insofar as motion allows the general concept of matter to be applicable to the empirical concept. In this sense, it "make[s] the concept of their [the mathematical physicist's] proper object, namely, matter, a priori suitable for application to outer experience, such as the concept of motion…"[21]

[21] MFNS 187; Ak.4:472: "So konnten also jene mathematische Physiker metaphysischer Principien gar nicht entbehren und unter diesen auch nicht solcher, welche den Begriff ihres eigentlichen Gegenstandes, nämlich der Materie, *a priori* zur Anwendung auf äußere Erfahrung tauglich machen, als des Begriffs der Bewegung…"

1. Reconstructing Kant's Argument for Explicating Matter via Motion

How does motion fulfill this mediating role? In the absence of Kant's argument to the effect, a possible reconstruction would run as follows: the search for an object in experience answering to the general concept of matter as the real in space should culminate in a definite substance; a substance is only known empirically as the subject of certain alterations; the only alterations conceivable for the minimal concept of something (real) in space is spatial alteration; spatial alteration, taken in the first instance simply as change of spatial relations, is motion; thus, only through motion can we begin to determine the in itself nominal concept of the real in space as of an object of experience.[22] Since the categories only function as necessary predicates of objectivity in regard to possible experience, the metaphysical explication of the possibility of matter in general – designating its essence – must follow the guidance of motion.

We will spend the greater part of this section examining the candidacy of various senses of motion in regard to this argument-scheme. To begin with, it is important to note that motion is here thought not as an empirically observed property, but precisely as the predicable described in footnote 30 in the last chapter. This observation accomplishes two things: first, it avoids employing (against Kant's proscriptions) any "other empirical

[22] Cf. MFNS 234; Ak.4:524: "But one should guard against going beyond that which makes possible the general concept of a matter as such… The concept of matter is reduced to nothing but moving forces, and one could not expect anything else, since no activity or change can be thought in space except mere motion." ("Man hüte sich aber über das, was den allgemeinen Begriff einer Materie überhaupt möglich macht, hinaus zu gehen… Der Begriff der Materie wird auf lauter bewegende Kräfte zurückgeführt, welches man auch nicht anders erwarten konnte, weil im Raume keine Thätigkeit, keine Veränderung als blos Bewegung gedacht werden kann.")

principle for the cognition of things" (MFNS 186; Ak.4:470); second, it avoids presuming that Kant's explanation of motion as the fundamental determination of matter because "only thereby can these [outer] senses be affected" (MFNS 191; Ak.4:477) refers to the motion of bodies as affecting outer sense in some (actual or anticipated) physical way.[23] Kant had explicitly said in the *Critique of Pure Reason*, "that it is not the motion of matter that causes representations in us, but that motion itself (hence also that matter that makes itself knowable through it) is a mere representation."[24]

2. Problems with the Reconstructed Argument

But now even if the concept of motion is assimilated into an argument of the type I outlined, the following objection should be raised against my interpretation: while such

[23] Konstantin Pollok (2006), 569-570, flirts with this notion before rejecting it without argument, presumably because the metaphysical nature of the claim does not allow for such an empirical, physiological account. He eventually goes on to accuse Kant of dithering on the issue (574) and leaving it in the obscurity that I feel actually characterizes Pollok's own presentation. Sifting through the latter, one finds the main assumption he makes in order to think sense-affection as connected with motion: "In order for matter to become the object of possible outer experience, something must be perceived; that is to say, the spatial distance between the subject of cognition and the object of cognition must be somehow traversed." (569) Since this traversal or motion is not a property of things in themselves (because, Pollok tells us, the *Metaphysical Foundations* does not study motion as a property of things in themselves), "[o]ne should begin instead with sensible outer affection by an appearance or a phenomenon" (569-570). But, "[s]ince Kant is concerned with the principle of the metaphysical theory of bodies which fixes the basic determination of any object's outer experience, an *a priori* statement is still involved" (570). Pollok then tries to unsuccessfully reconcile the empiricity of *both* the involved concepts, of motion and of matter. Distinguishing between the general and empirical concepts of matter, *a distinction present in the text*, and enunciating it more clearly than Kant did, avoids these pitfalls.

[24] A387: "…nicht die Bewegung der Materie in uns Vorstellungen wirke, sondern daß sie selbst (mithin auch die Materie, die sich dadurch kennbar macht) bloße Vorstellung sei…"

an argument may show that an object of the general concept of matter can be empirically known through the concept of motion, the PS claim talks *not* about knowing objects discursively but of motion *conditioning sense-affection*. Two problems stand in the way of making sense of Kant's PS claim in the latter way. Firstly, alteration of spatial relations as a condition of affectivity for outer sense seems insufficient in at least one respect, namely, that it does not take into consideration the mere production of a spatial presence and only covers changes in the field of outer appearance. A second deeper complication is that the claim itself turns out to be inconsistent with further developments in the main text, where Kant belabors to prove that attractive and repulsive forces define the possibility of matter.[25] There, Kant asserts: "Impenetrability, as the fundamental property of matter, whereby it first manifests itself to our outer sense, as something real in space, is nothing but the expansive force of matter."[26] The inconsistency is thus twofold: 1) Impenetrability, *not motion*, is held to be the fundamental property of matter whereby the latter first appears to outer sense, and impenetrability is equated with force, *not motion*; 2) Kant's proposed derivation of matter's fundamental *forces* from a purely *motion*-based phoronomical account fails on several counts,[27] and since Kant's predominant concern lies in producing a coherent dynamical *force*-based theory of matter, the failures reflect back on the motion-based picture as the starting point.

[25] For what follows, see Kant's Proof for the dynamical *Lehrsatz* 5 and the attached Remark (MFNS 220-222; Ak.4:508-510).

[26] MFNS 220; Ak.4:508: "Die Undurchdringlichkeit als die Grundeigenschaft der Materie, wodurch sie sich als etwas Reales im Raume unseren äußeren Sinnen zuerst offenbart, ist nichts als das Ausdehnungsvermögen der Materie."

[27] Commentators are unanimous on this point, so I will not detail these failures here. I shall have occasion to critically examine key moments of this theory later (Ch.3, f.n.65, Ch.4, Section I passim.)

These problems can at best be mollified, but not entirely dispelled. In regard to the first, Kant has not developed here an adequate phenomenological framework to even assess the in/sufficiency of spatial alteration as the sole condition of outer affection. The fact that he presents another version of this claim in the lines from the A-Paralogisms (A387) quoted on the previous page is, thus, even more surprising. Of course, the said lack of information is not by itself an objection, and it is tempting to turn to a Husserlian-type kinaesthetic account to help Kant here, but at the moment, I am interested in interpreting the theory rather than bolstering its legitimacy. As far as the second set of problems goes, it is evident that the inconsistencies become fatal for the concept of motion as an affectivity-condition when we strongly uphold the dynamical matter-theory on its own grounds. And a careful study of Kant's oeuvre undoubtedly speaks for the latter.[28] But if, in the interest of charitable interpretation, we attend only to the first moment of the problem pointed out, it is possible to distinguish between the conditions of outer affection that may lie in the subject (the *representation* of motion) and conditions of outer appearance that lie in the object (the *property* of impenetrability, a sufficient mark for cognizing matter[29]). The former appears to hold out some prospects for our investigation.

But this does not take us very far actually, for Kant is quite insistent on the point that motion (and alteration) are incomprehensible to us without the perception of *something* in space, for in space alone there is nothing movable and motion needs a

[28] See Edwards (2000), esp. chapter 7.

[29] Impenetrability is the "the first distinguishing mark of a matter" (MFNS 220; Ak.4:509: "[Wir bedienen uns] der Undurchdringlichkeit zum ersten Kennzeichen einer Materie…").

subject to inhere in.[30] This would mean that motion depends on outer affection, and not the other way around. So, one should ask instead if Kant talks about motion in respect of the conditions of outer affection, for instance, in respect of the pure intuition of space as the form of outer appearance. And we do find Kant equally comfortable talking about geometrical elements, thus elements of pure space, as being in motion, e.g., a line being the motion of a point.[31] This way of talking seems to overcome the above restriction of motion to outer perception, and although it does not directly assert such motion as the condition of outer affection, it at least frees it up for such a function. At the same time, it carries a cost: it becomes unclear whether geometrical cognition is premised upon the experience of movable items in space or is independent of it and how – that is, the relation of motion to outer affection also implicates and complicates the apriority of geometry upheld by Kant. I will explore this issue in detail now.

[30] E.g. A41/B58: "[T]he transcendental aesthetic cannot contain more than these two elements, namely space and time… all other concepts belonging to sensibility, even that of motion, which unites both elements, presuppose something empirical. For this presupposes the perception of something movable. In space considered in itself there is nothing movable; hence the movable must be something that is found *in space only through experience*, thus an empirical datum." ("[D]ie transscendentale Ästhetik nicht mehr als diese zwei Elemente, nämlich Raum und Zeit, enthalten könne… alle andre zur Sinnlichkeit gehörige Begriffe, selbst der der Bewegung, welcher beide Stücke vereinigt, etwas Empirisches voraussetzen. Denn diese setzt die Wahrnehmung von etwas Beweglichem voraus. Im Raum, an sich selbst betrachtet, ist aber nichts Bewegliches: daher das Bewegliche etwas sein muß, was *im Raume nur durch Erfahrung* gefunden wird, mithin ein empirisches Datum.") A similar passage is to be found at MFNS 195; Ak.4:482, although here Kant explains that 1) *mobility* as a property of an object in space cannot be known a priori and requires recourse to experience, and 2) therefore he could not "enumerate it under the pure concepts of the understanding in the *Critique of Pure Reason*."

[31] E.g. B291-292: "[Alteration]…cannot even be made understandable without intuition, and this intuition is the motion of a point in space…" ([Veränderung]…[die Vernunft] kann nicht einmal ohne Anschauung verständlich machen; und diese Anschauung ist die der Bewegung eines Punkts im Raume…"

3. Phoronomy and the Reconstructed Argument

Now, in the *Metaphysical Foundations*' first chapter (Phoronomy), Kant provides an account of the concept of motion as a pure quantum by using the language of moving points.[32] Perhaps this can add a decisive voice in the present discussion and merits dwelling upon; I will also use this opportunity to clarify some related misconceptions. Here, the motion of a point is supposed to help understand the motion of a body in space, since Kant conducts this phoronomical discourse in anticipation of its application to actual bodies in the later chapters.[33] We have already cursorily noted insurmountable

[32] MFNS 202; Ak.4:489: "The *composition of motion* is the representation of the motion of a point as the same as two or more motions of [this point] combined together." ("Die *Zusammensetzung der Bewegung* ist die Vorstellung der Bewegung eines Punkts als einerlei mit zwei oder mehreren Bewegungen desselben zusammen verbunden.")

[33] MFNS 194; Ak.4:480: "Since in phoronomy nothing is to be at issue except motion, no other property is here ascribed to the *subject* of motion, namely, matter, aside from *movability*. It can itself so far, therefore, also be considered as a point, and one abstracts in phoronomy from all inner constitution, and therefore also from the quantity of the movable… If the expression 'body' should nevertheless be used here, this is only to anticipate to some extent the application of the principles of phoronomy to the more determinate concepts of matter that are still to follow…" ("Da in der Phoronomie von nichts als Bewegung geredet werden soll, so wird dem Subject derselben, nämlich der Materie, hier keine andere Eigenschaft beigelegt, als die *Beweglichkeit*. Sie selbst kann also so lange auch für einen Punkt gelten, und man abstrahirt in der Phoronomie von aller innern Beschaffenheit, mithin auch der Größe des Beweglichen…Wenn gleichwohl der Ausdruck eines Körpers hier bisweilen gebraucht werden sollte, so geschieht es nur, um die Anwendung der Principien der Phoronomie auf die noch folgende bestimmtere Begriffe der Materie gewissermaßen zu anticipiren…") It is only with the dynamical consideration of matter through its property of filling space and, in turn, the concepts of impenetrability and repulsive force, that the quantity of the movable first comes into play, and matter is thought not merely as a point but as having determinate spatial extent. Michael Friedman [(2001), 64] reads the phoronomical consideration of matter as anticipatory of further determinations insofar as "the motion of a point involved in the drawing of a straight line yields a representation of *rectilinear inertial motion*—the privileged state of force-free motion serving as the foundation of all modern physics and thus for 'pure natural science'." I can see how rectilinearity is stipulated in both the geometrical production and the physical axiom, but I cannot see how the inertial aspect expressed in the latter has anything to do with *drawing* a straight line, unless I mean an absolutely steady hand holding pen to paper or a state of absolute mental calm, which I suspect are irrelevant considerations. Friedman recognizes this (see Friedman [1992], 42 & f.n.74, 20f.n. 30) and supplies an ingenious and involved justification of this claim that forms the cornerstone of his interpretation of the *Metaphysical Foundations*. But his interpretation is highly problematic and textually unjustified as is convincingly argued by Carrier, Edwards, and Westphal, although I cannot go into this now.

reservations in regard to the said application of phoronomy to the dynamical constitution of matter, hence, the phoronomical considerations of motion cannot be thought as conditions of outer affection along *those* lines and we leave that aside.[34] With this qualification, let us examine Kant's views on the topic.

First, Kant explains that the talk of moving points exceeds the proper sphere of pure geometry, for motion is here considered "as the *describing of space* – in such a way, however, that I attend not solely, as in geometry, to the space described, but also to the time in which, and thus to the speed with which, a point describes the space."[35] Now, even if it is admitted that we go beyond mere geometry this way, the suggestion lingers that we do attend to the speed of the production of a line in space (which forms the basis of Friedman's remark cited in f.n.33 above). But Kant rids us of this notion as well when he explains (with reference to his illustration on MFNS 203; Ak.4:490) that the lines "designating the speeds are, properly speaking, *the spaces they traverse* in equal times."[36] In fact, it is important to understand that the phoronomical principles really work by, as it were, reducing motion-representations to space-representations. That is, the

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[34] But this certainly does not rob the phoronomy of *all* value: "For the rules for the connection of motions by means of physical causes, that is, forces, can never be rigorously expounded, until the principles of their composition in general have been previously laid down purely mathematically." (MFNS 200; Ak.4:487. Translation modified: strangely, Friedman excises the phrase – *rein mathematisch* – "purely mathematically"; "Denn die Regeln der Verknüpfung der Bewegungen durch physische Ursachen, d.i. Kräfte, lassen sich, ehe die Grundsätze ihrer Zusammensetzung überhaupt vorher rein mathematisch zum Grunde gelegt worden, niemals gründlich vortragen.")

[35] MFNS 202; Ak.4:489: "…als *Beschreibung eines Raumes* betrachtet werden, doch so, daß ich nicht bloß wie in der Geometrie auf den Raum, der beschrieben wird, sondern auch auf die Zeit darin, mithin auf die Geschwindigkeit, womit ein Punkt den Raum beschreibt, Acht habe."

[36] MFNS 203; Ak.4:490 (my italics): ["D]ie Linien *AB* und *ab*, welche die Geschwindigkeiten bezeichnen, eigentlich die Räume sind, welche sie in gleichen Zeiten durchlaufen…"

phoronomical principles of constructing the concept of motion as a quantum describe, in essence, the conditions of grasping a composite motion, not itself as an intuition a priori, but *according to rules of spatial congruence*. In other words, congruence is a geometrical and a priori condition under which it becomes possible to compare numerically *different* motions (represented spatially) in order to assert their *identity*.[37]

4. Eric Watkins' Interpretation of the PS Claim

In the Phoronomy, Kant introduces notions such as the relativity of motion and the assumption of absolute space in the context of talking about our sense perception of motion.[38] These notions are subsequently put to the service of relevant constructions of

[37] Cf. Remarks 1 and 2 to *Lehrsatz* 1 of the Phoronomy chapter (MFNS 205-207; Ak.4:493-496). This is a crucial point to grasp for understanding Kant's construction procedures. In these, Kant asks us to posit a line representing a given motion (in absolute space) and imagine the motion of the relative space representing a second given motion, such that the second motion can be considered to have been *added* onto the first motion of the body on account of the relativity of empirical motion (i.e., I can equivalently attribute a motion to the body or to its relative space). Resultantly, I have the representation of a *composite* motion. As far as these 'imaginings' are concerned, they are just that – merely imagined representations lacking discursive grounding and thus *not* strictly geometrical conceptions; the geometrical conditions only enter this picture in the form of (discursive) *rules* of congruence that allow asserting the identities of these combined motions with each other and with the composite. Without these rules, a) I lose the condition of comparison of the various motion-lines, and b) my discourse is infected with 'un-geometrical' talk of moving lines. Also, notice that without thinking congruence into Kant's procedure, the illustration he provides (MFNS 203; Ak.4:490) for the case of adding two equal motions in the same direction, becomes the baseless assertion that one and the same line, which at the start expressed one motion, somehow at the end expresses twice that motion! A failure to understand the recourse to the conditions of a priori intuition made available via rules of congruence, therefore, reduces Kant's technical concept of construction to just another thought-experiment or a fancying something as so-and-so.

[38] See Remark 2 to *Erklärung* 1 of the Phoronomy chapter (MFNS 194-195; Ak.4:481-482). Kant argues that in sense perception motion appears against a sensitively perceived space (material or relative

the concept of motion as a quantum. Matter, as we have said, is here thought analytically as the subject of motion. It seems possible, then, to employ these notions in order to comprehend the elusive connection of matter and motion indicated in the PS claim. Eric Watkins (1998) claims to do this in arguing to the essential connection of the concepts of matter and motion, not by means of exposing their analytic containment, but by keeping in view those construction procedures. But his argument is flawed precisely in virtue of ignoring the aforesaid reference to the rules of spatial congruence, which reduces the technical concept of construction merely to an arbitrary thought-experiment and misses its methodological import altogether. Let us see how.

In respect of the PS claim, Watkins first dismisses the idea that an analysis of outer affection has anything to do with the essential mobility of matter.[39] Next, he sharpens the PS claim to read it as excluding in principle the possibility of an immobile matter in space as an object of outer sense, and justifying the claim in this form amounts to a transcendental argument in respect of outer experience.[40] Now, if I understand

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space), and given the definition of matter as movable in *Erklärung* 1, this material space is itself movable; thus the motion of a body is relative to an always containing space without the possibility of overcoming this relativity, since an absolute space (an immaterial, hence immovable frame of reference) is no object of perception. Nevertheless, just this infinity of conditions (movable frames of reference) engenders the *idea* of an unconditioned absolute space as an assumption made legitimately for the sake of possible experience.

[39] "Thus, Kant's remark should be taken, not so much as a justification of the claim that matter is essentially movable but rather as an expression of his belief that objects of outer sense must move in order to affect human beings' sense organs." (Watkins [1998], 579)

[40] Watkins interprets the *Metaphysical Foundations* as developing a transcendental argument in analogy with his interpretation of the task of the *Critique of Pure Reason*: "Just as the main question of the first *Critique* is 'How is experience of objects (in general) possible?' the main question of the *Metaphysical Foundations* is 'How is experience of objects of outer sense possible?' The first step of Kant's argument uses a transcendental argument to establish the most basic feature of matter, namely that any object of outer sense (i.e., any matter) is essentially something movable in space." (Watkins [1998], 577; cf. 586-587) His interpretive slant thus belongs to a tradition of reading the *Critique of Pure Reason* as a search for the conditions of possibility of experience, an approach that expressly overlooks Kant's own description of the central problem of that work as an inquiry into the possibility of synthetic judgments a priori (cf. B19 and

Watkins' argument correctly, he holds that just as time is not a direct object of perception, neither is space; and just as temporal position is nevertheless ascertained via transcendental argumentation (assuming this was shown in the *Critique of Pure Reason*), so a similar ascertainment of spatial position must be underwritten by the present transcendental argument, while keeping Kant's construction procedures in view. In Watkins' words, "[W]e cannot directly perceive position in objective space (position in space being the basic notion in terms of which motion must be explained). Rather, objective space must be constructed according to a procedure outlined in the *Metaphysical Foundations*'s chapter on Phenomenology."[41]

However, I do not find Kant outlining the procedure for constructing "objective space" in the Phenomenology chapter. Rather, his discussion there merely explicates the aforesaid remarks about the relativity of motion, absolute space, etc., in accordance with the categories of modality. Watkins mistakenly takes this discussion to be one of construction presumably because the crucial reference to geometrical rules of congruence eludes him. In place of a construction, then, he proceeds to set up a thought-experiment that is elegantly, even if redundantly, designed to show that one can always assert of any

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the Introductions). This difference of approach inevitably creates problems (and undeniably rich attempts at solutions) that are only due to misinterpreting the orientation of Kant's thought. Here, to take an instance among others, taking outer experience as a point of departure causes one to miss the task set by Kant's book in terms of applying the general concept of matter to objects of outer sense as I have argued.

[41] Watkins (1998), 580. There is some confusion due to Watkins' use of the term "objective space", by which he refers to what Kant calls "absolute space," though cleansed of any Newtonian sense of an absolutely independent thing. However, the context of Watkins' discussion (see above and his footnote 41) suggests that he thinks of this in analogy with the claim about time not being an object of perception, and accordingly, "objective space" would refer to space as a pure intuition. But this space simply cannot be constructed *by definition*, because *concepts* and not intuitions are constructed. Watkins' analysis of the difficulties of constructing objective space, therefore, becomes confusing and even though he arrives at the correct result, i.e., that objective space cannot be constructed, it is for the wrong reasons.

matter, even if it appears unmoved, that it would in fact count as moved if viewed from another possible frame of reference.[42] He concludes: "These considerations show how Kant argues for the basic determination of matter as the movable in space, namely through a transcendental argument explaining that an object of outer sense is possible for us only if it is movable in space."[43] I find this conclusion unwarranted and I believe that it stems from an unsteady grasp of "construction."[44]

5. Konstantin Pollok's Interpretation of the VS Passage

The above analyses of Kant's phoronomical discourse hopefully show that he is not guilty of infusing the geometrical realm with motions in any substantive sense beyond metaphor. By the same token, possible explanations of motion conditioning outer affection (by way of informing its formal features), which provoked the above reflections, lose some purchase too. There remain, however, Kant's statements from the

[42] "Accordingly, one can never exclude the possibility that although it may now appear that a given matter is not moving (or movable) according to a particular construction of objective space, a future construction of objective space might reveal it to be in fact moving (and thus movable)." (ibid., 580)

[43] Ibid., 581.

[44] In a symptomatic passage that may be revealing, Watkins plays down all reference to *a priori* intuition involved in the concept of construction: "How is this argument for the Third Law of Mechanics a transcendental argument? …The Third Law of Mechanics provides a rule for *constructing in intuition* the communication of motion, whereby *construction in intuition* demonstrates the possibility of what is to be constructed. In other words, the Third Law of Mechanics is a necessary condition for experiencing the communication of motion, since the Third Law is necessary for *construction in intuition* and *construction in intuition* is in turn necessary for the communication of motion to be possible." (ibid., 586; my italics).

B-Transcendental Deduction, which distinguished between Various Senses (VS) of motion – "objective", "transcendental", and "geometrical" senses, to use Pollok's terminology[45] – and we can now clarify their import in the present context. Objective motion presents no problems, since our troubles lie only with assessing any articulation of a pre-objective sense of motion. Geometrical motion, at least in respect of Kant's phoronomical treatments, too has been dealt with immediately above. Only the so-called transcendental motion, by which Pollok (following Kant) roughly understands the *act of synthesis* executed by the *subject of cognition*, remains to be considered.

Now, the questions in regard to the VS passage are: 1) In what sense is it legitimate to call synthetic acts in cognition *motions*? 2) What relevance do these acts/motions have for understanding the conditions of outer affection? To answer these questions and to determine the candidacy of this sense of motion for understanding Kant's PS claim, we should first look to the context of the VS statements. Pollok provides a context for the VS passage by reading it predominantly in light of a review by C.G. Schütz in 1785. Schütz pointed out that *drawing* (a line) is a kind of motion, and since motion is an empirical concept, it seems that geometrical figuration (and by extension, geometrical cognition) requires "empirical help."[46] Kant's VS passage clearly echoes Schütz' words and, for Pollok, aims to defuse his worry by making room for a

[45] See the passage cited as "VS = Various Senses" at Ch.1, f.n. 37.

46 "We only wished that Mr. K. could broach the following scruple. We cannot represent a line in an a priori intuition without drawing it in thought. Drawing, however, is a kind of motion; motion is an empirical concept; thus, it seems that even lines, and therefore also figures, and therefore also the conic figure, have need of empirical help [*auch die conische Gestalt einer empirischen Beyhülfe bedürfen*] in order to be represented." (Cited at Pollok [2006], 561) I suspect Schütz is referring to Kant's remark that the "shape of a cone can be made intuitive without any empirical assistance [*Die konische Gestalt wird man ohne alle empirische Beihülfe... anschauend machen können*]" (A715/B743).

"pure" motion in the form of the cognitive subject's synthetic activity and distinguishes this from "objective" motion, a merely empirical affair.[47]

This is fair enough as a context and certainly illuminative. But it leaves much in ambiguity, not least that we must rest on speculations fathoming Kant's inner intention in writing this passage from a review. Further, though it nicely follows from this speculation that Kant should wish to indicate that description of space is a kind of pure motion and not a kind of empirical motion and thus countering Schütz' objection, that is not what Kant actually says. He does not talk about 'description of space as a motion', but just the reverse, "motion, as *description* of space" (B155 f.n.). This does not directly counter Schütz' objection without ambiguity, and may well be implying that description of space is not itself a motion, but rather, that motion includes description of space as one of its aspects. And even if the expression intends the motion of describing a space as belonging to the pure realm of geometrical cognition, Kant's bare assertion to the effect would just beg the question – hardly a recommended strategy for a considered response. Finally, it is hard to see how "transcendental" and "geometrical" motions are either related or distinguished in Pollok's account.[48] So, this contextualization contains certain ambiguities and requires us to look further for a less equivocal one.

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[47] "Kant responds to this objection in the second edition of the *Critique* by emphasizing that the pure concept of 'motion' (subjective motion, or synthesis) should not be confused with the empirical concept of motion dealt with in natural science. As such, the passage from the B-edition constitutes an answer to Schütz's 'wish' that Kant distinguish *different* concepts under the heading of 'motion': the motion of an object and the motion of a subject." (ibid., 561-562)

[48] To be fair, Pollok provides indications to this effect (See Pollok [2006], 565-568 including the elaborate diagrams) but I admit that I cannot entirely cut through his rather haphazard array of quotations and terminology. From what I understand, Pollok's main reason for distinguishing 'transcendental' from 'geometrical' motions is that the former is "considered under the *general aspect* of synthesis" (p. 565; my italics), whereas the latter is restricted to just the "spatial aspect". First, however, Pollok does not clarify what a "general aspect" of synthesis is, which is confusing since Kant describes synthesis in a general way at §15, and the present section featuring the so-called transcendental motion (§24) is interested precisely in

Without disregarding Pollok's historical reminder, then, we can seek help from the *immediate* context of Kant's statements about motions in the VS passage. They belong to remarks supplementing §24 of the B- Deduction, where Kant is explaining his doctrine of self-affection and how this reinforces his distinction between apperception (the spontaneity of original self-consciousness) and inner sense (the receptivity in self-perception). His explanation rests on what he calls a "figurative synthesis," the result of a "transcendental action of the imagination," a "synthetic influence of the understanding upon inner sense" (B154). Neglecting details, Kant's theory of self-affection underscores the contribution of an a priori synthetic action by the imagination. Instances of just such active contribution are highlighted in the paragraph to which the VS statements belong: "We also always perceive this in ourselves. We cannot think of a line without *drawing* it in thought, we cannot think of a circle without *describing* it, we cannot represent the three dimensions of space at all without *placing* three lines perpendicular to each other at the same point…"[49]

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restricting that generality. Second, Pollok indicates that 'geometrical' motion abstracts from time in considering it only under a spatial aspect, but: **1.** This threatens all meaningful talk about motion at all in a geometrical context with which Pollok anyhow persists, e.g. "relative motion can also be predicated of mathematical points" (p. 567); and **2.** If we were abstracting from time, then it is not clear why the synthesis of spatial manifolds relevant to geometry should be *successive* (e.g., p. 567). Now, these difficulties are not solely of Pollok's making and do have sources in Kant's text. But it is important to isolate and develop the latter rather than weave them into an account that further confuses the matter. The main culprit generating various slides for Pollok, I believe, is his ambiguous term "pure theory of motion," which he uses in regard to transcendental motion (synthesis in a general aspect *and as presupposed by geometry*, e.g. on pg. 565) as well as for objective motion (since Kant himself said that natural science resolves into a pure theory of motion; see p. 560, 566). This concept seems to have its hands in all three realms of concern to Pollok and thus goes against his own efforts at maintaining them as distinct. In my exposition, I will avoid this expression altogether and tackle the abovementioned problems lurking in Pollok's account, in part to reject and in part to vindicate his insights from a firmer perch.

[49] B154: "Dieses nehmen wir auch jederzeit in uns wahr. Wir können uns keine Linie denken, ohne sie in Gedanken zu *ziehen*, keinen Cirkel denken, ohne ihn *zu beschreiben*, die drei Abmessungen des Raums gar nicht vorstellen, ohne aus demselben Punkte drei Linien senkrecht auf einander *zu setzen*…"

The first sentence may incline us to believe that Kant is indulging in garden-variety introspection and the talk of thinking lines and circles would concern not so much their concepts proper (logical content) but their existence as mental events (psychological performance). Since such introspection ultimately depends on empirical sense data, the talk of motion a few lines later would also be drawn from the empirical domain, and Kant would then merely be restating Schütz' point. But the following observations help contextualize this sentence more firmly and cause us to reject this temptation:

1) Kant explicitly opposes the present distinction between apperception and inner sense to its "customary" erasure in empirical psychology.[50]

2) Albeit obliquely, Kant had already introduced the present subject-matter in §18 in distinguishing between the merely subjective empirical unity of apperception from the objectively valid one *and* in linking the latter with the unifying of the manifold of the pure form of inner sense (time), while telling us that the former has no place in the present discussion.[51]

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[50] "[I]t is customary in the systems of psychology to treat *inner sense* as the same as the faculty of *apperception* (which we carefully distinguish)." (B153: "…man auch lieber *den innern Sinn* mit dem Vermögen der *Apperception* (welche wir sorgfältig unterscheiden) in den Systemen der Psychologie für einerlei auszugeben pflegt.")

[51] Kant's conception of the subjective unity of apperception in §18 is laden with several difficulties (See Allison [2004], 182-185). But it suffices for now to see that: 1) for systematic reasons, namely, as a premise for his proof in §20, he only needs an account of the *objective* unity of apperception in regard to its synthesis of *a manifold as such*; 2) introducing and rejecting the subjective unity of apperception only helps avoid extraneous mistaken conceptions coming in from an empirical psychology; 3) beyond these clarifications, Kant still makes place for the objectivity ascribed to the unity of the form of inner sense, by qualifying *the pure manifold of time* in terms of *a manifold as such*. There is simply no reason for him to do so at this point of his proof in §18 aside from anticipating the subject-matter of §24, that is, with an eye to outlining the contribution of a figurative synthesis brought about as an *objective* determination of inner sense to its pure unity through apperception. This reading concurs with Allison's strategy of dealing with empirical apperception and perception in the scope of the Deduction as well.

3) While we have called Kant's *examples* of drawing lines and describing circles by that name, it is worthwhile to note that their exemplarity far outstrips ordinary introspection – for, as Manfred Baum and Michael Friedman remind us, they roughly cover the founding postulates (1-3) of Euclid's *Elements*.[52]

4) The main section to which Kant's remarks belong (§24) distinguishes between the intellectual and figurative syntheses (*synthesis intellectualis* and *synthesis speciosa*), and of the former we can be said to be conscious, but of the latter we are unconscious.[53] In regard to the latter, Kant's examples are offered as ways of *making ourselves conscious* of the figurative synthesis, that is, the examples concern a "making conscious" or an enacting of that a priori synthesis, an action executed by the cognitive subject.[54]

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[52] Cf. Baum (1986), 140-141 and Friedman (1992), 40. Baum also points out that Kant's "examples" are none other than the ones that received ample praise from Newton in his *Principia* (cf. Newton [1999], 381-382), a praise recounted by Kant himself as he cites Newton's lines in the *Metaphysical Foundations* (MFNS 192; Ak.4: 478-479). The praise concerned the vast output geometry can boast of from so few initial 'principles', i.e., drawing a line and describing a circle. Baum implicitly draws our attention to the fact the that whereas Newton in these lines had in mind the grounding of geometry in mechanical postulates, Kant in his rendition, interestingly, does not contest this as he ought to if geometry is not to require the "empirical help" of the sort that Schütz worries about. That Kant *should* object, however, is clear from comments at A234/B287, A713-714/B741-742; Ak.20:410-411; Kant (1973), 110-111 (Ak.8:191-192) & 175-177 (Ak.20: 419-422).

[53] This is too complex a claim to analyze here fully, but initial plausibility can be won on its behalf by pointing to the fact that the intellectual synthesis just is an account of self-consciousness as including my consciousness of a combination of representations as all together mine; on the other hand, Kant mentions unconscious syntheses in §15 (B130), which must accordingly refer to the other type, i.e., figurative synthesis. For an adequate defense see Allison (2004), 168-172; for a compressed but compelling account of how this claim organizes the much debated bipartite structure of the B-edition's Transcendental Deduction see Baum (1986a), 100-106; and for an expanded discussion see Baum (1986), 78-148 passim.

[54] Cf. Baum (1986), 142, which identifies this act, following Kant, with motion: "This making-conscious is an act of motion [*Bewegung*], which can be exercised by means of the (productive) power of imagination upon the pure manifolds of space." (My trans.) On p. 158, Baum explains how this act conditions outer knowledge: "…all outer appearances are thus subject to those synthetic determinations of space, which are understood with apodictic certainty in the axioms and propositions of Euclidean geometry,

These remarks establish not only that Kant is not indulging in armchair reflection that would infect his concept of motion as an 'action of the subject' with empirical impurity, but also that he has in mind the primordial syntheses of space and time that are clearly of fundamental import for geometrical cognition. And insofar as these syntheses allow him to describe the condition under which the categories apply to appearances (§26), the significance of these acts belongs "not only to geometry, but even to transcendental philosophy" (B155 f.n.) His cavalier naming these inner acts of consciousness 'motions' jars our ears a little, but we can see from the historical context that the fundamental postulates of geometry were conceived precisely as a result of certain 'motions' – a view expressed forcefully by Newton that first gives rise to Schütz' worry. Kant, then, simply employs an already loose expression[55] in order to let his

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whereby a pure mechanics (doctrine of body) also becomes possible *when one adds the fundamental experience of motion* [*Grunderfahrung der Bewegung*]." (My trans. and italics). Unlike Baum, I tend to worry about the homonymy of "motion" in these two claims. Perhaps the talk of "adding a fundamental experience" assures him that "motion" in the first and second claims is not the same. "Fundamental experience", for Baum, presumably recalls Kant's assertion that "we cannot anticipate general natural science, which is built upon certain fundamental experiences [*gewisse Grunderfahrungen*]" (A171-172/B213). But we know from our exposition of the *Metaphysical Foundations* that Kant has excluded all appeal to empirical concepts (save the existential affirmation of matter), thus also the said fundamental experience of motion; and then this regenerates my worry.

[55] I supply two further historical remarks complementing the context Pollok helpfully provides:
1. Reconfiguring Kant's distinction between 'subject' and 'object' motions as one between 'loose talk' and that reserved for natural scientific inquiry lets us recall another well-known precedent, namely, Descartes' distinction between the 'vulgar' and 'proper philosophical' concepts of motion in his *Principia* (Descartes (1983): 51; *Pr*. II 24, 25). Though Descartes had very different uses for his concepts, in light of the above both philosophers appear to regard the 'looser' sense of the concept as importing ideas of 'subjective effort', an agent's 'doing', and seek to differentiate it from the 'stricter' ascription of objective predicates for altering spatial positions. This should fortify the conviction that Kant's use of "motion" to describe the subject's actions merely registers the term's flexibility.

2. Locke in his *Essay Concerning Human Understanding* (Cf. II.xiv.1-8 and ff.) had explained the origin of the concept of succession in an inner reflection of the mind upon its "train of ideas" and also sought to deny the origin of this idea in externally observed motion. Because external motions appeared to provide a *measure* for temporal determinations, Locke held that others had mistakenly ascribed the origin of the idea of *succession* thereunto as well. Kant's main emphasis in the VS passage is to show that the main temporal characteristic – the *concept* of succession is

contemporary audience connect with an existing theme of inquiry. Lastly, this talk of the subject's motion does not in the least endanger the status of geometry as an a priori science, because qua an investigation of the subjective sources of a priori cognition, it aims at explaining the apriority affirmed of geometrical cognition and says nothing about our factual practice of geometry.

If what I have said is correct, then we may use the word "motion" to refer to the synthetic acts of the imagination only to indicate the generation of formal intuitions. But this bit of verbal hygiene, one will notice, only responds to the first of my two questions (see the second paragraph of the present sub-section). The second question still demands to know the relevance it bears in respect of the PS claim – i.e., whether it can condition outer affection in some sense specific to Kant's project in the *Metaphysical Foundations*. That is, can his concept of figurative synthesis function as the *sole explanation* of how the outer senses can be affected?[56] At first sight this seems wildly improbable, for one can easily imagine innumerable processes responsible for outer affection. But that would be to either leave the Kantian terrain of ignorance about noumenal interaction or a return to empirical psychological considerations. Also, if the very question is of securing the metaphysical grounds of natural science, then all appeals to metaphysically 'ungrounded' cognitive-psychological theories are ruled out for fear of circularity as well. Importantly,

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not derived from the given manifold of inner sense, but rather it is the result of the understanding's action upon that manifold (a kind of reflection after all) which "first produces the concept of succession at all" (B155). This proximity to yet difference with the Lockean account would help explain why Kant would at all choose to use the term "motion" in just the way he does, as another name for the subject's *pure* act of 'reflection.' Also see Kant (1973), 117ff (Ak.8:199ff) for a response to Eberhard's reduction of motion to a succession of representations in inner sense; though this text postdates the VS passage, it expresses a familiar contemporary notion.

[56] "The basic determination of something that is to be an object of the outer senses had to be motion, because *only thereby* can these senses be affected." (MFNS 191; Ak.4:476; my italics: "Die Grundbestimmung eines Etwas, das ein Gegenstand äußerer Sinne sein soll, mußte Bewegung sein; denn *dadurch allein* können diese Sinne afficirt werden.")

such answers would also miss the force of emphasis in the question, which is asking whether figurative synthesis or motion as the action of the subject may be the *only explanation* of outer affection there is on Kant's terms. The question construed thus, the answer turns out to be an emphatic 'yes' – for the only account of sense-affection the critical Kant provides at all is via the figurative synthesis.[57]

True, the PS claim is about affecting *outer* senses whereas the theory of figurative synthesis is expounded in regard to the understanding affecting *inner* sense, and this is a further problem. One cannot appeal here to the fact that the stuff of inner sense ultimately comes from outer sense, because the very issue is about how that stuff first comes to be for outer sense. An option is to look for traces in Kant's works explaining the effect of the understanding or the imagination upon outer sense,[58] and another would be to explore the co-dependency of space- and time-representations in the theory of self-affection itself.[59] I do not intend to pursue these possibilities at the moment since we would need to prepare ground for those inquiries on another plane of discussion, and instead I wish to first recapitulate the results of the present discussion.

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[57] If this is true, then Pollok is wrong to hold this concept as irrelevant to the *specific task* of the *Metaphysical Foundations*. I believe I have just shown its relevance qua an explanation of affection, and I have done so without engaging Pollok's (confusing) reasons for maintaining the opposite (see f.n. 23).

[58] Baum (1986), 138 f.n.89 alerts us of this possibility: "That the power of imagination also affects outer senses is asserted by Kant's *Reflexionen* 3613 [*sic*] and 3619 [*sic*]." (This must be a typographical error, and the correct references must be to *Reflexionen* 6313 and 6319).

[59] E.g. Baum (1986), 141; Longuenesse (1998), 227-242.

6. Reconciling the General and Empirical Concepts of Matter through Motion

The main aim of this section, "Motion and Mathematics," was to understand the PS claim. Upon the basis of the results of the previous section, I was able to read this claim as enunciating the role of the concept of motion as mediating between the general and empirical concepts of matter. This mediation signified the condition under which explicating the possibility of matter as an object of experience itself became possible. At the same time, Kant's own justification of the PS claim, if at all one, was obscure and compelled devising a possible argument for this purpose. The concept of motion employed in that argument was a predicable (pure but derived concept of the understanding) and appeal to such a concept rested on Kant's statement in regard to the "general concept of matter in general" that "no activity or change *can be thought* [*gedacht werden kann*] in space except mere motion."[60]

But while this reconstruction gives grounds for Kant's recourse to the concept of motion for the sake of the metaphysical explication of matter, it did not fully capture Kant's belief that this recourse was necessitated by the conditions of outer affection. Accordingly, I undertook an examination of candidate concepts of motion that could have purchase on this feature neglected by the reconstruction. Using Pollok's names for these candidate concepts, it became evident that two of these cannot possibly do the job:

[60] MFNS 234; Ak.4:524. My italics

"Objective" motion cannot do so because a) it is an empirical concept in addition to that of matter and this is excluded by Kant on principle, b) Kant warns against conceiving outer affection as a sort of physical collision with sense organs to which this concept leads, and c) in some sense we needed a *pre*-objective concept of motion; "Geometrical" motion too proved unsatisfactory because, in the course of rectifying misconceptions about Kant's Phoronomy, we were able to qualify the use of this concept as merely metaphorical. "Transcendental" motion, however, positively addresses this feature to the extent that it alone, qua the figurative synthesis, explains affection consonant with the transcendental idealist framework.

Thus, this sense of motion must be retained as significant for Kant's purposes in the *Metaphysical Foundations* along with the previous sense that stipulates the concept of motion as a predicable. This is good news inasmuch as we can now fulfill both the obligations that characterized this concept from the start, namely, that it should provide a conceptual point of access to a categoreal explication of the essence of matter and that it allow of being developed as a condition of (outer) affection. But just as clearly one sees that it is imperative for Kant's project to purge this duality in the sense of motion. That is, motion as a predicable and motion as a figurative synthesis must be shown identical or at least compatible. This concept is supposed to fulfill a mediating role between the general and empirical concepts of matter, and to seek yet another external mediation for its own twofold aspects would be to invite obvious rebuke.

7. Reconciling Motion with Itself

Kant, however, fails to provide any further clues in regard to such an identity, in lieu of which I offer the following remarks in the spirit of bolstering just such a claim.

Psychologism. One prima facie obstacle in the path to an identity arises on account of the apparently heterogeneous natures of these two "motions," for the one is a concept and the other a (cognitive) action. To assert an identity here would then be to egregiously conflate the logical and the psychological. But, to mitigate this worry to some extent, first, it will be recalled that for Kant concepts are ultimately *acts* of spontaneity and this underlies Kant's distinction, not between the logical and the psychological, but between the logical and the transcendental-logical.[61] Second, while

[61] Consider A68/B93: "[C]oncepts… [rest] on functions. By a function, however, I understand the unity of the action of ordering different representations under a common one. Concepts are therefore grounded on the spontaneity of thinking…" ("…die Begriffe [beruhen] also auf Functionen. Ich verstehe aber unter Function die Einheit der Handlung, verschiedene Vorstellungen unter einer gemeinschaftlichen zu ordnen. Begriffe gründen sich also auf der Spontaneität des Denkens…") and A57/B81: "In the expectation, therefore, that there can perhaps be concepts that may be related to objects a priori, not as pure or sensible intuitions but rather merely as acts of pure thinking, that are thus concepts but of neither empirical nor aesthetic origin, we provisionally formulate the idea of a science of pure understanding and of the pure cognition of reason… Such a science, which would determine the origin, the domain, and the objective validity of such cognitions, would have to be called *transcendental logic*…" ("In der Erwartung also, daß es vielleicht Begriffe geben könne, die sich *a priori* auf Gegenstände beziehen mögen, nicht als reine oder sinnliche Anschauungen, sondern bloß als Handlungen des reinen Denkens, die mithin Begriffe, aber weder empirischen noch ästhetischen Ursprungs sind, so machen wir uns zum voraus die Idee von einer Wissenschaft des reinen Verstandes und Vernunfterkenntnisses... Eine solche Wissenschaft, welche den Ursprung, den Umfang und die objective Gültigkeit solcher Erkenntnisse bestimmte, würde *transscendentale Logik* heißen müssen…") I agree that this is not a full answer to the problem of psychologism in Kant's thinking of these matters, but I also happen to think this is an enormously interesting if ignored area of Kant's thought and not a minor aberration that can be wished away as Kant's defenders have done (either by simply stating a preference for it as at Allison [2004], 147 or sanitizing it away as Hanna does in his rich and fashionable portrayals of a Frege-inspired semanticist Kantianism).

motion as figurative synthesis has been understood in terms of a "making-conscious," not merely the psychological quality of awareness but the production of unities of pure manifolds of intuition is at issue. Third, although the question of psychologism infecting Kant's transcendental logic cannot be dealt with fully here, it is important to observe that the transcendental-logical approach does not merely assume that there are first-level psychical acts whose effects are second-level logical formations. The latter would be a psychologism in the sense of an assumption of psychic existences modeled on known objective existences (e.g., insofar as they exhibit causality) yet employed to explain heterogeneous logical-semantic elements of knowledge. Rather, Kant shows:

1) that a distinction between pure and empirical representations can be made in the case of intuitions (in the Transcendental Aesthetic) and *this* leads to asking whether a similar distinction applies to concepts, which are after all representations as well;

2) the understanding is thought as a faculty of conceptual knowledge on the basis of our common experience of actually understanding things and if there are pure concepts, then this would correspondingly involve a pure understanding;

3) if we project the understanding as a faculty of cognition on the grounds of certain acts of understanding that we perform all the time, it makes sense to look for the acts of the pure understanding too.

Now, Kant's thesis is that those acts of the pure understanding are shown up best in attending to the figurative synthesis. There is indeed much that remains questionable in this brief account, not least the talk of actual cognition in terms of acts (and not, for

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Hegel and Husserl both accused Kant of psychologism but did not just banish this issue, but rather, developed philosophical systems that could incorporate it within transcendental frameworks.

instance, the truth of propositions). But it is at least a first approximation for seeing how Kant is not merely assuming built-in compartments in our head that fire off various syntheses and come to be known as concepts, in which case equating an assumed motion 'in our head' and the concept of motion would be absurd.

Succession. A common element in the two concepts of motion is succession. The predicable, "motion," is a representation of successive determinations of an existence in space, and the figurative synthesis is marked by its successive character, and is even held responsible for our concept of succession. Beyond a superficial resemblance, this concept should produce a robust compatibility of the two concepts of motion in virtue of its being a two-way operator between them in the following way: On the one hand, we noted that, for Kant, the concept of succession results from the figurative synthesis. It arises insofar as I abstract from spatial manifolds consciously combined in such a synthesis and concentrate on the penumbral trace of the combining itself. Now, nothing in the concept of a line or any other spatial figuration *necessitates* the idea of succession, nor is inner sense a *store* of pre-assorted data from which this idea could be drawn. Thus, it is due to the nature of such an action (of the understanding that thinks the combination of spatial parts in any spatial figure *as I represent this to myself* in inner sense) that the concept of succession first arises. In other words, motion (as action of the subject) produces the concept of succession. On the other hand, Kant also holds that the concept of succession makes the concept of motion itself possible. By this he means that the character of time explains *a priori* how a state of affairs corresponding to the description "something is here and also not-here" could *really* obtain. Such a description would be the predicable-concept of motion as an alteration of place and because succession makes

motion meaningful a priori, it is a condition of possibility of all theory of motion. Accordingly, a passage added in the B-edition of the *Critique of Pure Reason* (written after the *Metaphysical Foundations* and clearly referring to it) states:

> [T]he concept of motion (as alteration of place), is only possible through and in the representation of time – that if this representation were not a priori (inner) intuition, then no concept, whatever it might be, could make comprehensible the possibility of an alteration, i.e., of a combination of contradictorily opposed predicates (e.g., a thing's being in a place and the not-being of the very same thing in the same place) in one and the same object. Only in time can both contradictorily opposed determinations in one thing be encountered, namely, *successively*. Our concept of time therefore explains the possibility of as much synthetic a priori cognition as is presented by the general theory of motion…[62]

Another Instance. Finally, the view that Kant could have maintained an identity between a predicable and the transcendental synthesis of the imagination, as suggested by my reconstruction of the central argument of the *Metaphysical Foundations*, is supported by noticing another key concept facing a similar situation – that of *number*.[63] This is evident from juxtaposing two appearances of this concept in the *Critique of Pure Reason*, one from Kant's remarks upon the structure of his table of categories in §11 added to the B-edition, and the other from the Schematism chapter.

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[62] B48-49: "[D]er Begriff der Bewegung (als Veränderung des Orts) nur durch und in der Zeitvorstellung möglich ist; daß, wenn diese Vorstellung nicht Anschauung (innere) *a priori* wäre, kein Begriff, welcher es auch sei, die Möglichkeit einer Veränderung, d.i. einer Verbindung contradictorisch entgegengesetzter Prädicate (z.B. das Sein an einem Orte und das Nichtsein eben desselben Dinges an demselben Orte) in einem und demselben Objecte, begreiflich machen könnte. Nur in der Zeit können beide contradictorisch-entgegengesetzte Bestimmungen in einem Dinge, nämlich *nach einander*, anzutreffen sein. Also erklärt unser Zeitbegriff die Möglichkeit so vieler synthetischer Erkenntniß *a priori*, als die allgemeine Bewegungslehr…darlegt."

[63] Cf. Longuenesse (1998), 255-263 for a discussion of this problem and an attempt at its solution.

The second of his three remarks in §11 concerns the fact that there are always three categories under each of the four classes or headings in his table of categories. Kant clarifies that the third of each set is derived from the first two yet only on account of an original act of understanding distinct from those two; these 'third' categories, therefore, are *not* derivative pure concepts of the understanding, i.e., predicables. In this context, he mentions the example of the concept of number.[64] The concept of number 'belongs' to the category of totality as a predicable.[65] It contains the concepts of unity and plurality that also go toward the content of the category of totality. The concept of infinity is a predicable too, and it too contains the concepts of unity and plurality but without becoming a number.[66] Kant can therefore prove that the mode of combining the concepts of unity and plurality in the concepts of number and infinity are not identical and 'belong' to *different* kinds of acts of combining these representations. If the act in the category of totality was identical with the acts in the concepts of unity and plurality,

[64] B111: "Thus *allness* (totality) is nothing other than plurality considered as a unity… But one should not think that the third category [like allness or totality] is therefore a merely derivative one and not an ancestral concept of pure understanding. For the combination of the first and second in order to bring forth the third concept requires a special act of the understanding, which is not identical with that act performed in the first and second. Thus the concept of a *number* (which belongs to the category of allness) is not always possible wherever the concepts of multitude and unity are (e.g., in the representation of the infinite)…" ("So ist die *Allheit* (Totalität) nichts anders als die Vielheit, als Einheit betrachtet… Man denke aber ja nicht, daß darum die dritte Kategorie ein bloß abgeleiteter und kein Stammbegriff des reinen Verstandes sei. Denn die Verbindung der ersten und zweiten, um den dritten Begriff hervorzubringen, erfordert einen besonderen Actus des Verstandes, der nicht mit dem einerlei ist, der beim ersten und zweiten ausgeübt wird. So ist der Begriff einer *Zahl* (die zur Kategorie der Allheit gehört) nicht immer möglich, wo die Begriffe der Menge und der Einheit sind (z.B. in der Vorstellung des Unendlichen)…")

[65] "Number" and "Infinity" are mentioned as predicables at Kant (1997), 156; Ak.29: 802. As a predicable, the concept of number is that of a discrete quantum being a determinate plurality containing units as simple parts (Cf. Kant [1997], 464; Ak.29: 996).

[66] Kant has several concepts of infinity at his disposal (e.g. A431-432/B459-460, Kant (1997): 332-333; Ak.29:834-838, Kant (1997): 192-195; Ak.28:568-569, etc.), but the one relevant here is the "mathematical concept of infinity" defined as "a multiplicity (of given units) that is greater than any number." (A432/B460 f.n.)

then there could not be such a differentiation in their combinations as evidenced by the concepts of number and infinity. It is important for our purposes, however, to note that in this proof the latter concepts must be taken as derived from the original pure concepts of the understanding, i.e., as predicables.

Besides the description of it as a predicable, Kant also talks of number as a schema, where the latter essentially contains a reference to the figurative synthesis. We came across the figurative synthesis earlier in connection with self-affection as the generation of formal intuitions generally on account of the formal determination of the inner sense by the understanding. The Schematism chapter employs this notion to specify particular procedures of such determination in accordance with the categories so that the synthesis applies not merely to pure manifolds of intuition but conditions its application to "all representations" and thus appearances as well. *Number* is one such procedure or schema:

> The schema of a pure concept of the understanding… [is] the pure synthesis, in accord with a rule of unity according to concepts in general, which the category expresses, and is a transcendental product of the imagination, which concerns the determination of the inner sense in general, in accordance with conditions of its form (time) in regard to all representations, insofar as these are to be connected together a priori in one concept in accord with the unity of apperception.[67]

[67] A142/B181: "[D]as Schema eines reinen Verstandesbegriffs… ist nur die reine Synthesis gemäß einer Regel der Einheit nach Begriffen überhaupt, die die Kategorie ausdrückt, und ist ein transscendentales Product der Einbildungskraft, welches die Bestimmung des inneren Sinnes überhaupt nach Bedingungen seiner Form (der Zeit) in Ansehung aller Vorstellungen betrifft, so fern diese der Einheit der Apperception gemäß *a priori* in einem Begriff zusammenhängen sollten."

> The pure *schema of magnitude* (*quantitatis*), however, as a concept of the understanding, is *number*, which is a representation that summarizes the successive addition of one (homogeneous) unit to another.[68]

Of course, a number of complicated Kantian doctrines swarm around the passages just cited, but let not that obscure the simple point I want to draw attention to: in these passages, Kant provides an instance of another key concept (number) that is comfortable with both being counted as a predicable and comprising a figurative synthesis.

IV. Results of this Chapter

In the light of the above three sections of this chapter we are now in a position to properly reflect on the sense of Kant's method in this project, which will reveal both further support for my reading as well as some problems for further analysis. The guiding thread for my reading, as I mentioned in chapter 1, was the goal of drawing a closer relation between the *Critique of Pure Reason* and the *Metaphysical Foundations*. The immediate structural basis of my reading, however, was a reconstruction of Kant's argument as mediating between the general and empirical concepts of matter by means of the concept of motion. The latter was justified through a close reading of the text of the *Metaphysical Foundations*, and I explicitly omitted any evaluative discussion of the argument that came to light on purely textual grounds. This discussion is now due and

[68] A142/B182: "Das reine *Schema* der *Größe* aber (*quantitatis*) als eines Begriffs des Verstandes ist die *Zahl*, welche eine Vorstellung ist, die die successive Addition von Einem zu Einem (gleichartigen) zusammenbefaßt."

we will see that Kant's reasons for following out the train of thought I uncovered hearken to precisely some fundamental principles espoused in the *Critique of Pure Reason*.

Chapter 3

Kant's Phoronomical Theory and the Problem about Sensation

In the previous chapter we saw that the project of the *Metaphysical Foundations*, to the extent that it rests on *defining* matter as movable, can be defended by reconstructing this definition. The latter involved taking the concept of motion as a predicable, which was shown to be related to the Critical doctrines of self-affection and the transcendental synthetic acts of the imagination. We also noted that such a defense, in turn, rested on surgical niceties such as ignoring any talk of transcendental affection, extracting Kant's phoronomical analyses from his flawed dynamical theory of matter, and admitting the incomplete explanation of specifically *outer* affection given through the account of self-affection. The greater interest through all this lay in interpreting Kant's theory and comprehending a possible justification for his project, if it was to even get off the ground, and not so much in evaluating this justification for its own sake. Also, this was done in a way such that the main structural connections between the *Metaphysical Foundation* and the *Critique of Pure Reason* could emerge into clearer view.

Now, we have to switch gears to reveal the implications of this way of reading the two texts. We will evaluate Kant's justifications using both intrinsic and extrinsic yardsticks available in his own further uses of the concept of movable matter as a starting point of his metaphysical analyses and in the reception of his project by his earliest critics such as Hegel. While the previous chapters have shown *that* and *how* Kant offers a

definition of movable matter, this and the next chapter will ask *how good* is Kant's definition by elaborating the question about that *for which* it may or may not be good. In my present chapter, the 'for which' I consider in some detail is the use of the definition in the first chapter of the *Metaphysical Foundations*, Phoronomy. Here, Kant 'constructs' the concept of motion as a quantum and matter is treated merely as a function of motion. Yet, Kant wants to move from a purely formal description of movable matter to an empirical standpoint and ground the merely mathematical exposition in a discourse of apprehending outer appearances as such.

I will argue that his efforts are not entirely successful and that we find reasons in this failure to uncover deep-seated connections between Kant's phoronomical concept of matter and the doctrine of the Anticipations of Perceptions in the *Critique of Pure Reason*. This allows certain conjectures for reforming Kant's project from the ground up and it sets the stage for appreciating Hegel's criticisms, which I reconstruct in the following chapter. In a word, Kant's problems have to do essentially with his efforts to think *sensation* into the abstract mathematical-physical theory he sets up; and Hegel's somewhat casual complaints that Kant's *sensationistic* account of rational physics is a flawed and incoherent venture gets hold of the core of Kant's problems, if we read into Hegel's criticisms carefully. In order to get from here to there, this chapter proceeds through the following sections:

First, I describe two problems facing Kant's phoronomical explication of matter as movable – a circularity in the construction procedures that affects the use of the concept of quantity for grasping motion and a lack of clarity about the concept of empirical space that articulates the principle of this construction (Section I). To get a

better grip on these issues, I examine Kant's construction procedure from the point of view of its appeal to rules of congruence (Section II). We learn that this appeal, while having transcendental grounds consonant with the concept of motion as explained in the previous chapter, still presupposes given quantities for motion (Sections III, IV). The latter presupposition can be made comprehensible only through a reference to sensation (Section V), which, in turn, requires us to work through Kant's proof of the Anticipations of Perceptions, which tries to build an a priori theory for sensation (Section VI). I turn to the concept of "empirical space," with which Kant tries to mediate between his purely geometrical and his physical analyses and show how this concept is entangled in various difficulties that crop up when theorizing a priori about sensation. This leads to a dilemma which foregrounds the intimate (and deeply problematic) links between Kant's matter theory and his transcendental principle dealing with sensation (Section VII). I close with some speculations upon the overall failure of the Phoronomy to overcome the two initial problems mentioned in the first section with an eye to Hegel's criticisms (Section VIII).

I. Phoronomy and Perceptible Spaces

There are two main problems that I will discuss in the Phoronomy, which may be named as "circular reasoning in constructing motion as quantity" and "perception and materiality of relative space":

1) The goal of the Phoronomy is to construct the concept of motion as a quantum, which shows the objective reality of this concept, and indirectly, of matter as the analytic subject of determination through this concept. But the construction procedure that Kant outlines begins with speed and direction as those aspects of motion that already have quantitative purchase and the construction shows how to add or compute with *these* quantities. This appears to be blatantly circular, since one may accuse Kant of having presupposed the quantitative aspects of motion in order to demonstrate through construction procedures the quantitative composition of motion (again).

2) Kant's phoronomical discourse describes the empirical framework of perceiving motion, which is crucial for setting up the aforesaid process of construction. In particular, Kant argues from the infinite regress contained in the relativity of all empirical perception of motion to notions like absolute space, etc., which are used in his construction procedure. But the primary factor engendering this infinite regress is an unsupported assumption about the materiality of empirically perceived relative space: *because* this space is material, it is movable according to the definition of matter as movable, and *this* generates the infinite regress of conditions of perceiving a given motion. How a space is perceived and what makes it material, however, is not understood clearly.

I will commence the present analysis by seeing how the two aforementioned items make their appearance. They are deeply intertwined in Kant's text and accordingly require a back-and-forth approach through their exposition. And if they are to be made to

speak loudly and faithfully of their author's intentions, the two items will have to be first interpreted as charitably as possible. With these cautionary caveats in place, let us turn to their analysis.

Having at his disposal the definition of matter as movable, the Phoronomy chapter sets out to explicate the concept of motion as a quantum (and of matter as the subject of this quantum, such that we can explain conditions of mathematically constructing *this* concept of matter). But between that definition of movable matter and the new concept of motion as a quantum lie Kant's arguments concerning the concept of *empirical* space and the subsequent generalization to infinity of this space so as to yield the idea of *absolute* space. The idea of absolute space captures the following state of affairs: so far as matter's motion is apprehended empirically, it occurs in an empirical space; if empirical spaces are material, then by virtue of the definition of matter as movable, these spaces are themselves movable and thus presuppose a higher order space within which they move; if the higher order space, again, is material and hence movable, it presupposes a still higher order space for apprehending its motion, and so on; the unending progress of empirical, conditioned spaces leads to the *idea* of an absolute unconditioned space that can put an end to this infinite regress and in which all motion of matter must be thought such that matter's motion in empirical space may be apprehended at all to begin with.

Kant's 'regulative employment' of the idea of absolute space affirms the relativity of all empirical motion – since absolute space is not an object of experience (as the infinite regress of empirical conditions shows), the empirical knowledge of motion cannot include a reference to absolute space; hence, all empirical motion is relative. At the same time, it seems one cannot make do without such an appeal to absolute space for

the sake of the experience of motion. Now, Kant does not establish the objective reality of an absolute space through mathematical construction to escape this dilemma and, in fact, relinquishes all support from absolute space for treating empirical motion. Instead, he affirms the ineluctable relativity of empirical motions and the logical universality of an always higher order space that is implicit in this view. A motion is empirically known, Kant claims, only through comparison with yet-another space. Owing to the logical idea of higher order spaces that underwrites this comparison and functions as a regulative principle, this space of comparison may be assumed as immaterial and unmovable for the sake of the said experience of motion, even though and precisely because nothing in experience answers to such an idea.

> Since I have the enlarged, although still always material, space only in thought, and since nothing is known to me of the matter that designates it, I abstract from the latter, and it is therefore represented as a pure, nonempirical, and absolute space, with which I compare any empirical space, and in which I can represent the latter as movable (so that the enlarged space always counts it as immovable). To make this into an actual thing is to transform the *logical universality* of any space with which I can compare any empirical space, as included therein, into a *physical universality* of actual extent, and to misunderstand reason in its idea.[1]

Two points about this argument involving infinite regress in the empirical perception of motion command attention. First, it is clearly the initial assumption that *empirical space is material* which generates the regress, and we need to clarify this premise. Second, how does Kant put the reflections on the relativity of empirical motion

[1] MFNS 195; Ak.4:481-482: "Weil ich den erweiterten, obgleich immer noch materiellen, Raum nur in Gedanken habe und mir von der Materie, die ihn bezeichnet, nichts bekannt ist, so abstrahire ich von dieser, und er wird daher wie ein reiner, nicht empirischer und absoluter Raum vorgestellt, mit dem ich jeden empirischen vergleichen und diesen in ihm als beweglich vorstellen kann, der also jederzeit als unbeweglich gilt. Ihn zum wirklichen Dinge zu machen, heißt die *logische Allgemeinheit* irgend eines Raums, mit dem ich jeden empirischen als darin eingeschlossen vergleichen kann, in eine *physische Allgemeinheit* des wirklichen Umfanges verwechseln und die Vernunft in ihrer Idee mißverstehen."

and the idea-assumption of absolute space to use? That is, we need to sharpen our understanding of how the affirmed relativity of empirical motion is related to the construction of matter as the subject of motion-as-a-quantum. Let us start with the second question as this foregrounds the difficulties with the first: Kant uses the idea of the relativity of all empirical motion to articulate the sole phoronomical principle *that* one may arbitrarily attribute a given motion either to the body or *to its relative space*[2] and lays out the construction procedure for motion as a quantum on the basis of this 'arbitrary attribution.' But even before examining the details of the constructions, one notices about their principle that the attribution of motion (and rest) to a relative space hearkens back to the first point about a space being material and movable. Let us now turn to some features of the phoronomical constructions.

II. Construction and the Rules of Congruence

I spoke about the construction of the quantity of motion in the previous chapter in the course of reviewing Eric Watkins' interpretation and pointed out that the nerve of Kant's discourse on this topic was his appeal to the rules of congruence (Ch.2, sections

[2] MFNS 200; Ak.4:487: "PRINCIPLE. Every motion, as object of possible experience, can be viewed arbitrarily as motion of the body in space at rest, or else as rest of the body, and, instead, as motion of the space in the opposite direction with the same speed." ("*Grundsatz 1.* Eine jede Bewegung als Gegenstand einer möglichen Erfahrung kann nach Belieben als Bewegung des Körpers in einem ruhigen Raume, oder als Ruhe des Körpers und dagegen Bewegung des Raumes in entgegengesetzter Richtung mit gleicher Geschwindigkeit angesehen werden.") In the following pages of my analysis, all mention of the "phoronomical principle" refers to this statement.

III.3,4). Kant claimed that it was only by means of congruence, as a geometrical condition for the presentation of the quantitative combination of motions, that a phoronomical (and not mechanical) presentation of such combination in intuition a priori was possible. I did not pause to examine the soundness of this claim, merely resting at that stage with the question of interpreting Kant's doctrine. In particular, I did not question whether and how Kant's appeal to the rules of congruence[3] was itself justified. It appeared that Kant overcame the merely thought-experimental character of his construction procedure by stipulating that the rules of congruence alone yielded the a priori *intuitive* presentation of the concept of motion as a pure quantum.

Without these rules, then, the a priori intuitive dimension of the argument was missing and did not amount to a construction in Kant's technical sense of the term. If we assume, somewhat simple-mindedly for a moment, that the rules of congruence count among the axiomatic conditions of geometrical cognition, then it is at least understandable why Kant would think that a reference to these rules is conducive to geometrical cognition relevant to the said constructions. But it is not clear what *compels* this reference to rules of geometrical congruence and the justification of this reference seems somewhat contrived. But if we do not make this assumption,[4] then the corresponding piece of justification attached to it falls away altogether. Then, the

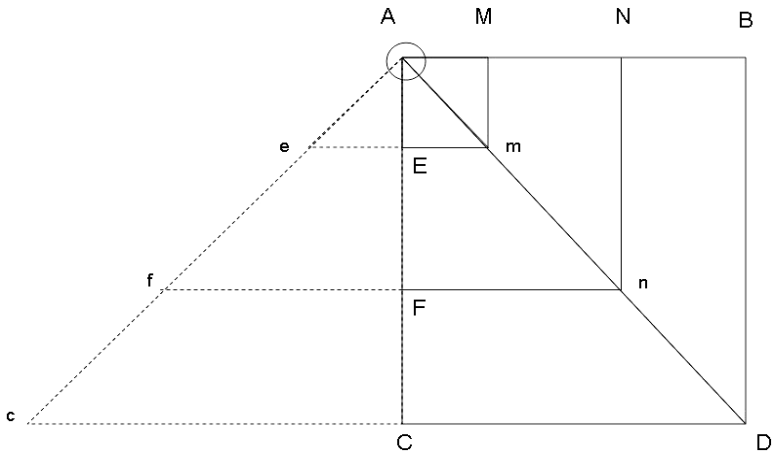
[3] Note that I am not talking about any specific rules of congruence but merely the appeal to *any* such rules. Kant does not specify which rules he may have in mind and I explain this below. For a good account of Kant's thoughts on geometrical congruence and its intellectual background, see Sutherland (2005). Also cf. Mancosu (1996), esp. 28-33 for the historical debates on the topic.

[4] It should be remembered that Euclid did not specify the rules or even the procedure of congruence by that name. Upon *our* anachronistic projections, some of the propositions in his *Elements* and their subsequent use in that text would count as theorizing congruence, and speculations about these productively informed the theory and practice of mathematics in the modern period without reaching unanimity on the topic.

presumed rules of congruence may easily count among propositions issued in the developed body of geometrical knowledge and not among its foundational principles, in which case invoking these rules could not in the least go any distance towards generating a geometrical-cognitive framework.

To settle this issue, let us speculate upon how Kant *may* have thought that these rules of congruence have any purchase.[5] To my mind, the nature of the appeal to the rules of congruence is best seen by inspecting the last of the three constructions outlined by Kant. Kant considers the cases of the combination of two equal motions of a point in a line when the component motions are contained (i) in the same direction in a line, (ii) in opposite directions in a line, and (iii) *in different lines comprising an angle*. All the constructions maintain that one must posit one of the given component motions in absolute space and the other given motion as the motion of the relative space (of the first motion) but whose direction is taken as the opposite of the original given second motion. The third case of motions at an angle is accordingly pictured as follows (I replicate Kant's "Figure 3" at MFNS 204; Ak.4:492):

[5] Although, as mentioned, Kant neither specifies the rules of congruence relevant to the constructions nor how they have been applied therein.



AB and AC represent two given equal component motions as to speed and direction and BAC represents the angle between them. AC may be posited as occurring in absolute space and, instead of AB, the relative space of the first given motion (AC) may be said to proceed by an equal amount in the opposite direction (along BA). The equivalence of the latter motion of the *relative space* with the motion of the *body* in the second of the original given component motions follows from the phoronomical principle (f.n. 2). Now, divide AC in equal parts AE, EF, FC, and when the body moves from A to E in absolute space, the relative space may be said to move along Ee = MA, and so on till the motion of the *body* along AC is correlated with the motion of the *relative space* along Cc=BA. Now, transposing back the motion of the relative space to the body (according to the phoronomical principle) gives us the desired solution:

> But all of this is precisely the same as if the body A had traversed the lines Em, Fn, and CD = AM, AN and AB [respectively] in these three parts of the time, and in the whole time, in which it traverses AC, the line CD = AB. It is thus in the last moment at the point D, and in this whole time successively at all points of the diagonal AD, which therefore expresses both the direction and speed of the composite motion.[6]

The line AD represents the desired composite motion as the line drawn through the plotted points m, n,… (depending on how often we divide the original component motions). Working backwards and supposing that the rules of congruence yield AD as a solution, the problem would have been to understand the value of AD as equal to the value of its reflection Ac in the reflected triangle ACc resulting from the representation of the motion of the relative space. If that were the case, then the problem would have been to show the congruence of the triangles ACc and ACD. Since, in Kant's diagram these are arbitrarily taken to be right triangles sharing a side AC and since we also know by definitions and transpositions that Cc = CD, the two triangles ACc and ACD are congruent by the rule of congruence that states two triangles are congruent when two sides and the included angle are equal. In that case, the value of AD is determined, since by congruency Ac = AD.

There are at least three problems with this account. First, the congruency of the two triangles can be shown only in the case that these are right triangles, but cannot be known with the given data (lengths AB and AC and the angle between them) if the angle between AB and AC are anything other than a right angle. Kant's construction procedure

[6] MFNS 205; Ak.4: 493: "…welches alles eben dasselbe ist, als ob der Körper *A* in diesen drei Zeittheilen die Linien *Em*, *Fn*, und *CD* = *AM*, *AN*, *AB* und in der ganzen Zeit, darin er *AC* durchläuft, die Linie *CD* = *AB* durchlaufen hätte. Also ist er im letzten Augenblicke im Punkte *D* und in dieser ganzen Zeit nach und nach in allen Punkten der Diagonallinie *AD*, welche also sowohl die Richtung, als Geschwindigkeit der zusammengesetzten Bewegung ausdrückt."

had explicitly not limited itself to only one angle, when he noted of his diagram that "it may, as here, be a right angle, but also any arbitrary oblique angle," and so this cannot be right.[7] Second, this procedure would count as a solution at all if we knew the value of Ac, which we do not know. Third, the setting up of congruent triangles would be altogether redundant because the construction of the triangle ACD emerges by plotting the line AD along points m, n,… If we already thus "have" AD, then "finding" AD through congruence is entirely unnecessary. So, where precisely does the appeal to the rules of congruence make itself felt according to Kant?

To answer this question and to see what work the rules of congruence then do, let us review the construction procedure and see what the appeal to rules of congruence does *not* do. *If* the goal was to find AD as the composite motion from given motions AB and AC and any angle between the latter two, then one could essentially reproduce Kant's results in the following way. First, we divide AB and AC in as many equal parts as Kant does too in his procedure. Then, instead of the detour through a reflected set of points, one could simply draw from the (n^{th}) dividing points on any one line as many segments *parallel* to the second line with lengths equal to (n^{th} multiple of) the equally spaced divisions on the second line. The line drawn through the end points of each such pair of line segments and connected to A (the vertex of the original component motions) would

[7] MFNS 205; Ak.4:492: "…er [der Winkel] mag wie hier ein rechter, aber auch ein jeder beliebige schiefe Winkel sein." Kant can extricate himself from this by admitting that for the purposes of constructing motion as a quantum, constituent motions *must* indeed be taken as at right angles to each other. This does not commit him to the absurdity of all mechanical interaction occurring at right angles alone, since the phoronomical construction does not constrain mechanical collisions, and it will in fact aid computations of collisions in any direction by resolving these along right angled co-ordinates (although if and only if the colliding bodies, after the collision, actually become one with regard to their conjoint conserved motion). But this subterfuge is not enough for the purposes of my reconstruction as there are two more objections above.

represent the composite motion AD. No appeal to rules of congruence is made in this construction and yet the same result is arrived at, which helps us now see where Kant thinks the appeal to congruence makes itself felt. For Kant is aware of this alternative that I just sketched out and he rules it out by saying:

> Now if these two [original component] motions were to occur at the same time in the directions of AB and AC, and in one and the same space, then they would still not be able to occur at the same time in the two *lines* AB and AC, but only in lines running parallel to these. It would therefore have to be assumed that one of these motions effected a change in the other (namely, directing it from the given path), if both directions were to remain the same. But this is contrary to the presupposition of the Proposition [which talks about mathematical "composition" and not causal changes…][8]

By abjuring the alternative construction through parallel lines, Kant's own construction procedure avoids reference to changes inflicted by one motion on another and preserves the cause-free status of phoronomical discourse. His procedure attains its goal by way of positing motions in separate spaces and transposing relative motions between these. The rules of congruence, thus, would be applied to allow for these transpositions (and not to establish congruent triangles to find the desired composite motion), which avoids the problems pointed out above. Consider the following remarks in light of this information:

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[8] MFNS 205; Ak.4: 492: "Wenn nun diese zwei Bewegungen zugleich in den Richtungen *AB* und *AC* und zwar in einem und demselben Raume geschehen sollen: so würden sie doch nicht in diesen beiden *Linien AB* und *AC* zugleich geschehen können, sondern nur in Linien, die diesen parallel laufen. Es würde also angenommen werden müssen: daß eine dieser Bewegungen in der anderen eine Veränderung (nämlich die Abbringung von der gegebenen Bahn) wirkte, wenn gleich beiderseits Richtungen dieselbe blieben. Dieses ist aber der Voraussetzung des Lehrsatzes zuwider…" The "Proposition" mentioned in the third sentence of the quotation refers to the *Lehrsatz 1* of the Phoronomy, quoted below. Kant's second sentence ends with the main conditional clause "*wenn gleich beiderseits Richtungen dieselbe bleiben*," which Friedman translates as "if both directions were to remain the same." I suggest that "although both the directions remain the same" captures Kant's sense better (although my suggested translation, like Friedman's, requires typographical emendations) and shows the contradiction Kant indicates more clearly.

Lehrsatz 1. The composition of two motions of one and the same point can only be thought in such a way that one of them is represented in absolute space and, *instead of the other*, a motion of the relative space with the same speed occurring in the opposite direction is represented *as the same as the latter*.[9]

All geometrical construction of complete identity rests on congruence. Now this congruence of two combined motions with a third (as with the *motus compositus* itself) can never take place if these two combined motions are represented in one and the same space, for example, in relative space.[10]

[T]his construction is possible in no other way than through the *mediate* composition of two equal motions, such that one is the motion of the body, and the other the motion of the relative space in the opposite direction… For two equal speeds cannot be combined in the same body in the *same direction*, except through external moving causes… This construction is possible in no other way, however, except through the combination of the motion of the body with the *motion of the space*…[11]

[9] MFNS 203; Ak.4:490 (my italics): "*Lehrsatz 1.* Die Zusammensetzung zweier Bewegungen eines und desselben Punkts kann nur dadurch gedacht werden, daß die eine derselben im absoluten Raume, statt der anderen aber eine mit der gleichen Geschwindigkeit in entgegengesetzter Richtung geschehende Bewegung des relativen Raums als mit derselben einerlei vorgestellt wird."

[10] MFNS 205; Ak.4:493: "Alle geometrische Construction der völligen Identität beruht auf Congruenz. Diese Congruenz zweier zusammenverbundenen Bewegungen mit einer dritten (als dem *motu composito* selbst) kann nun niemals Statt haben, wenn jene beide in einem und demselben Raume, z.B. dem relativen, vorgestellt werden."

[11] MFNS 206; Ak.4:494: "Diese Construction ist aber auf keine andere Art möglich, als durch die *mittelbare* Zusammensetzung zweier gleichen Bewegungen, deren eine die des Körpers, die andere des relativen Raumes in entgegengesetzter Richtung… Denn in *derselben Richtung* lassen sich zwei gleiche Geschwindigkeiten in einem Körper gar nicht zusammensetzen, als nur durch äußere bewegende Ursachen… Diese Construction ist aber nicht anders möglich, als durch die Verbindung der Bewegung des Körpers mit der *Bewegung des Raums*…"

III. Some Qualifications to the Account of Congruence

This makes clear that the appeal to congruence supports the *identity* of the various quantities transposed according to the phoronomical principle. In fact, Kant adopts a stronger version of such a support and holds that *only* congruence allows the geometrical representation of the given transpositions. The transpositions themselves stem from the phoronomical principle about the equivalence obtaining between the motion of a body and the motion of its relative space. But Kant states above that congruence alone allows the geometrical representation of identities obtaining between those and is necessary for presenting them as well as the resultant composition in intuition a priori. Further, notice that it is not any particular rule of congruence that governs the geometrical representation of these transpositions. Rather, what Kant means by the appeal to *rules* of congruence are the very conditions regulating congruence, which, on the dominant (though certainly not unquestioned) view of the day, consisted in superimposing a figure on another through translation and rotation (and assuming rigid motion across this superposition).[12]

[12] Kant's endorsement of such a view is inferred from statements such as those in a pre-critical essay, *Von dem ersten Grunde des Unterschiedes der Gegenden im Raume*, where he says, "If two figures drawn on a plane surface are equal and similar, then they will *coincide with each other*" (Kant [1992] 369; Ak.2: 381: "Wenn zwei Figuren, auf einer Ebene gezeichnet, einander gleich und ähnlich sind, *so decken sie einander*"), "A spherical triangle can be exactly equal and similar to another such triangle, and yet still not *coincide with it*" (ibid. 370; Ak.2: 381: "Ein sphärischer Triangel kann einem andern völlig gleich und ähnlich sein, *ohne ihn doch zu decken*"), "I shall call a body which is exactly equal and similar to another, but which cannot be *enclosed in the same limits as that other*, its incongruent counterpart… Since the surface which limits the physical space of the one body cannot serve as a boundary to limit the other, no matter *how that surface be twisted and turned*…" (ibid. 370-371; Ak.2: 382: "Ich nenne einen Körper, der einem andern völlig gleich und ähnlich ist, ob er gleich *nicht in eben denselben Grenzen kann beschlossen werden*, sein incongruentes Gegenstück… Weil diese Oberfläche den körperlichen Raum des einen begrenzt, die dem andern nicht zur Grenze dienen kann, *man mag ihn drehen und wenden, wie man will*…"). I have removed Kant's italics and inserted my own in the above quotations.

For Kant, these would be included among conditions of presenting concepts in intuition a priori, which is to say that they would belong to the conditions of mathematical cognition in general. And if the latter are necessarily related to the imagination's transcendental synthetic activities expressed by the term "transcendental motion,"[13] then so would be the said rules of congruence.

However, care must be exercised to evaluate the above construal of Kant's appeal to congruence, since a number of issues are enmeshed together at this point. To begin with, there are three distinct concepts of motion at play that should be kept separate: 1) "transcendental motions" or the pure synthetic acts of the imagination that primordially determine spatial manifolds, 2) "rigid motions' that are assumed in the talk of congruency by superposition, which relate already constituted, determinate spaces and figures to each other, and 3) the representation of "the motion of a body according to speed and direction" and "the concept of motion as a quantum", which are the explicit objects of the given phoronomical constructions. In particular, there is simply no reason to identify rigid motions (2) and transcendental motion (1) and a further reason against such an identification will be considered below. Similarly, there is a danger of slippage between (2) and (3) in the talk of transpositions that issue from the phoronomical principle – i.e., the transpositions are of quantities of motion (3) through congruence, which presumes rigid motions (2), but are not themselves those rigid motions qua conditions of congruence but only in accord with them.

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[13] Cf. B154-155 and the extended discussion around this concept in Ch.2.III above.

Aside from terminological disambiguation, a host of theoretical-strategic considerations crowd the issue as well, which have been convincingly portrayed by Daniel Sutherland in his work on Kant's philosophy of mathematics,[14] and which generate significant tensions in the text under study. Sutherland's (2005) treatment of the question of congruence is pertinent to the present context. Here, he explains that historico-strategic concerns (ranging over Kant's positions on Euclid's 'common notions' and (Eudoxian) theory of proportions as they were received in the Leibniz-Wolff-Baumgarten milieu) compel Kant to assume rigid motion as the condition of congruence and also to analyze congruence in terms of equality and part-whole relations. In gist, Kant cannot reduce equality to congruence (like Leibniz) because the latter holds only for *spatial* figures whereas Kant maintains a more *general* theory of magnitudes where equality plays an important, independent role. This role, Sutherland goes on to argue, draws upon Kant's theory of intuition and the *production* of magnitudes through the understanding's determination of the pure manifolds of intuition, (which are ideas developed through the doctrines of the transcendental acts of the imagination and of the axioms of intuition that rest upon it.[15])

The justification of the appeal to the rules of congruence should keep these terminological and strategic caveats in mind. And as will become clearer, this also opens the way to an important problem mentioned at the start of our analysis, which concerns the presupposition of a concept of quantities in constructing the concept of motion as a

[14] Sutherland (2004), (2005), etc.

[15] In conjunction with Sutherland (2005), see Sutherland (2004) and (2004a), which develop this aspect, i.e., the theory of magnitude in the *Critique of Pure Reason*, in greater detail.

quantum. So far we have seen that the rules of congruence make phoronomical transpositions 'possible' in the sense that they enable their geometrical construction. The terminological caveats warn against reducing the conditions of congruence, e.g., the notion of rigid motion, to the transcendental acts of the imagination or the so-called transcendental motion. This is because the latter are responsible for generating spatial magnitudes, which are presupposed by the former's operation with already constituted spatial magnitudes. Similarly, the theoretico-strategic caveat against reducing equality to congruence implies that congruence is logically posterior to the production of magnitudes through the synthesis of the manifold in pure intuition. Thus, both provide reasons to qualify the appeal to the rules of congruence in making transpositions of quantities 'possible' inasmuch as they indicate the logically posterior character of the rules of congruence to the synthetic acts that first generate the magnitudes compared.

This, at least initially, clarifies why Kant's construction of the concept of motion as a quantum by appealing to the rules of congruence *still requires* pre-given quantities. And *this* aspect now needs to be studied to complete our examination of the justification of the appeal to the rules of congruence. It also allows us to proceed to the physical register of the problem, i.e., the consideration of transposed motions in phoronomical constructions and the question of a material, movable space tied to it. Kant himself emphasizes the convergence of these factors in a closing remark to the phoronomical constructions: "The composition of motions, in order to determine their ratio to others as quantity, must take place in accordance with the rules of congruence, which is only possible in all three cases [of construction] by means of the motion of the space, which is

congruent to one of the two given motions, so that the two together are congruent to the composite [motion]."[16]

IV. Quantum and Quantity of Motion

Recall that the problem which Kant addresses with his construction procedures is that motion presents us with intensive and not extensive quantities, and the former cannot be added up in the same way as the latter.[17] The constructions get around this difficulty by a sort of 'reduction to space,' as I called it in the previous chapter. But, before all else, one is right to ask how we know that motions are intensive quantities or quantities at all? This appears to be a prior problem for any account that purports to construct the concept of motion as a quantum. But, instead of first showing how motion may be a

[16] MFNS 207; Ak.4: 494-495 (Translation modified): "Die Zusammensetzung der Bewegungen, um ihr Verhältnis zu andern als Größe zu bestimmen, muß nach den Regeln der Kongruenz geschehen, welches in allen dreien Fallen nur vermittelst der Bewegung des Raums, die mit einer der zwei gegebenen Bewegungen kongruiert, und dadurch beide mit der zusammengesetzten kongruieren, möglich ist."

[17] MFNS 206; Ak.4:493-494: "If, however, one explicates a doubled speed by saying that it is a motion through which a doubled space is traversed in the same time, then something is assumed here that is not obvious in itself – namely, that two equal speeds can be combined in precisely the same way as two equal spaces – and it is not clear in itself that a given speed consists of smaller speeds, and a rapidity of slownesses, in precisely the same way that a space consists of smaller spaces. For the parts of speed are not external to one another like the parts of the space, and if the former is to be considered as a quantity, then the concept of its quantity, since this is *intensive*, must be constructed in a different way from that of the *extensive* quantity of space." ("Erklärt man aber eine doppelte Geschwindigkeit dadurch, daß man sagt, sie sei eine Bewegung, dadurch in derselben Zeit ein doppelt so großer Raum zurückgelegt wird, so wird hier etwas angenommen, was sich nicht von selbst versteht, nämlich: daß sich zwei gleiche Geschwindigkeiten eben so verbinden lassen, als zwei gleiche Räume, und es ist nicht für sich klar, daß eine gegebene Geschwindigkeit aus kleinern und eine Schnelligkeit aus Langsamkeiten eben so bestehe, wie ein Raum aus kleineren; denn die Theile der Geschwindigkeit sind nicht außerhalb einander, wie die Theile des Raumes, und wenn jene als Größe betrachtet werden soll, so muß der Begriff ihrer Größe, da sie *intensiv* ist, auf andere Art construirt werden, als der der *extensiven* Größe des Raumes.")

quantity, Kant simply tells us that his analysis will take up those aspects of motion that "can be considered as quantity in motion (speed and direction)."[18] It is assumed without further ado that speed and direction yield those quantitative aspects through which the quantitative being of motion may be explored.

Although, pre-theoretical experience of motions gives us a sense of "fast" or "slow," and "this way" or "that," and not quantized measures of speed and direction, Kant may be making the commonsensical assumption that the latter concepts, which empirical physics works with, reflect the former pre-theoretical experiences adequately.[19] Kant's own job in the *Metaphysical Foundations* is to explain the a priori grounds whereby the physicists' concepts have well-founded suitability for outer experience. Yet, how can Kant simply take these concepts from an empirical-theoretical sphere as germane to his metaphysical project, and moreover, can he do so in light of his stipulation that no other empirical concept aside from the concept of matter belongs to the scope of his inquiry?

The only criterion Kant seems to supply for concept selection in the Phoronomy is its constructability.[20] So, for instance, the notion of rest endorsed in the Phoronomy is

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[18] MFNS 194; Ak.4:480: "…als Größe betrachtet werden kann (Geschwindigkeit und Richtung)."

[19] Cf. Remark 3 to Explication 2 (MFNS 197-198; Ak.4:483-485): "In every motion direction and speed are the two moments for considering motion, if one abstracts from all other properties of the movable. I here presuppose the usual definitions of both"; "In phoronomy we use the word 'speed' purely in a spatial meaning C=S/T." ("In jeder Bewegung sind Richtung und Geschwindigkeit die beiden Momente der Erwägung derselben, wenn man von allen anderen Eigenschaften des Beweglichen abstrahirt. Ich setze hier die gewöhnliche Definition beider voraus"; "In der Phoronomie brauchen wir das Wort Geschwindigkeit blos in räumlicher Bedeutung C=S/T.")

[20] That is, even if Kant does not adhere to this criterion himself, e.g. cf. his remarks on the impossibility of constructing matter as composed of fundamental forces on MFNS 234ff; Ak.4:525ff. In these passages, he admits that "if the material itself is transformed into fundamental forces (whose laws we cannot determine a priori, and are even less capable of enumerating reliably a manifold of such forces

one which does not mean the absence of motion altogether, for absence is not a concept that can be presented in intuition; rather, if rest is thought as a limit-case of motion, one having an infinitely small speed, its concept (supposedly) allows for construction and may be adopted for use in a metaphysically justified physics.[21] Kant persuades us to think rest in the second way by recalling the experience of a body that rises to a certain height and then loses motion under the influence of gravity before falling down.[22] Here, the empirical reference is incidental to his semantic choice, which is constrained solely by the tenability of a concept for construction.

Speed and direction would similarly be 'inspired' by experience as concepts fruitful for quantizing motion, but they are selected through considerations of constructability. Since Kant uses constructability and not experience as a criterion for his semantic decisions, this partly mitigates the objection that he oversteps his stipulation against empirical concepts. Predicable-concepts of matter as "something real in space" and of motion as "change of spatial relations" produce various notions of speed and

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sufficient for explaining the specific variety of matter), we lack all means for *constructing* this concept of matter, and presenting what we thought universally in intuition." ("…wenn der Stoff selbst in Grundkräfte verwandelt wird (deren Gesetze *a priori* zu bestimmen, noch weniger aber eine Mannigfaltigkeit derselben, welche zu Erklärung der specifischen Verschiedenheit der Materie zureichte, zuverlässig anzugeben, wir nicht im Stande sind), uns alle Mittel abgehen, diesen Begriff der Materie zu construiren und, was wir allgemein dachten, in der Anschauung als möglich darzustellen.")

[21] MFNS 199-200; Ak.4:486: "Thus rest cannot be explicated as lack of motion, which, as = 0, can in no way be constructed, but must rather be explicated as perduring presence at the same place, since this concept can also be constructed, through the representation of a motion with infinitely small speed throughout a finite time, and can therefore be used for the ensuing application of mathematics to natural science." ("Also kann die Ruhe nicht durch den Mangel der Bewegung, der sich als = 0 gar nicht construiren läßt, sondern muß durch die beharrliche Gegenwart an demselben Orte erklärt werden, da denn dieser Begriff auch durch die Vorstellung einer Bewegung mit unendlich kleiner Geschwindigkeit eine endliche Zeit hindurch construirt, mithin zu nachheriger Anwendung der Mathematik auf Naturwissenschaft genutzt werden kann.")

[22] MFNS 199; Ak.4:485-486.

direction as articulating a matter's motion (i.e., qua change of outer relations with reference to time and space)[23] and Kant is content to select that version which accords with concept construction. Therefore, a certain notion of speed and of direction has been selected from the sphere of empirical physics as capable of supporting the required constructions by permitting the quantitative conceptualization of motion. More importantly, however, let us recount Kant's thought up to this stage in order to see whether he has presupposed the concept of motion as a quantum in the process, thus making his phoronomical constructions fully otiose.

In the Preface, Kant had claimed that the possibility of a determinate natural thing (like matter), that is, a priori knowledge about its nature, is only secured via constructing its concept. The concept of matter contained the concept of motion as a fundamental predicate, so constructing the concept of matter must involve motion, and Phoronomy undertakes this task by constructing the concept of motion as a quantum. At this stage, no reference is made to speeds and directions as empirical concepts used by physicists. The concept of motion as a quantum is a categorial determination (i.e., according to the category of quantity) of the fundamental predicate of matter and as such it is the concept of motion expressing a combination of motions.[24] How can we have a priori insight into

[23] With this context, if we now read a statement from the Preface to the *Metaphysical Foundations*, which we encountered before, it seems to clearly state a methodological guideline in just such a respect: "a complete analysis of the concept of matter in general [is undertaken in philosophy, which]… makes use of no particular experiences, but only that which it finds in the isolated (although intrinsically empirical) concept itself, in relation to the pure intuitions in space and time (in accordance with laws that already essentially attach to the concept of nature in general)" (MFNS 187; Ak.4: 472). In the Phoronomy, the qualification about laws of nature in general has only a negative significance, because Kant excludes causal concepts from the phoronomical sphere. Also, cf. Kant's Remarks to Explications 2 and 3 in this chapter, which reflect on various other concepts of speed and direction before settling on the preferred versions that permit construction (MFNS 196-199; Ak.4:482-486).

[24] MFNS 202; Ak.4:489: "The determinate concept of a quantity is the concept of the generation of the representation of an object through the composition of the homogeneous. Now since nothing is

this concept? Kant tells us: by constructing it, presenting it in pure intuition. But it is not motion *simpliciter* that is constructed; rather it is motion *according to direction and speed*, concepts already endowed with quantitative charge, which is at issue in the phoronomical constructions. The conditions of presenting *this* concept in intuition a priori yield the metaphysical principle of matter as the subject of motion-as-a-quantum.[25]

The question, therefore, is about the switch made from one set of concepts (*quantum*, categorial determination) to the other (*quantities*, speed, direction, constructible-empirical determinations). Though Kant often uses a single German term, *Größe*, which has been variously translated as *magnitude*, *quantity*, *size*, etc., nevertheless he makes a distinction in the Latin between *quantum* and *quantitatis*, which does much philosophical work in his theory of mathematics as well his theory of experience.[26] To keep sight of this, in the following I will use the terms *quantum* and *quantity* respectively as translations for these terms. Briefly: when we speak of the concept of motion as a *quantum*, we are not asking after its 'how much', but merely asking after its mode of being per the composition of a homogeneous manifold in

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homogeneous with motion except motion in turn, phoronomy is a doctrine of the composition of the motions of one and the same point in accordance with its speed and direction…" ("Der bestimmte Begriff von einer Größe ist der Begriff der Erzeugung der Vorstellung eines Gegenstandes durch die Zusammensetzung des Gleichartigen. Da nun der Bewegung nichts gleichartig ist, als wiederum Bewegung, so ist die Phoronomie eine Lehre der Zusammensetzung der Bewegungen eben desselben Punkts nach ihrer Richtung und Geschwindigkeit…")

[25] Of course, how matter *is* the subject of which motion is predicated – the dynamical explication of motion as a quality of matter – this aspect of Kant's theory fails, as mentioned earlier.

[26] Guyer and Wood add a helpful footnote (p. 286-7 of their translation of the *Critique of Pure Reason*) on these terms: "According to C.C.E. Schmid's *Wörterbuch zum leichteren Gebrauch der Kantischen Schriften* (Jena: Cröcker, 1798), *Größe* as *quantitas* refers primarily to the pure concept of quantity, while *Größe* as *quantum* refers to '*eine Größe* in concreto' ." For interpretations of the *quantum-quantitatis* distinction in Kant, see Sutherland (2004), 427-435; Sutherland (2005), 148-151; Friedman (1992), 107-114 & ff; Longuenesse (1998), 263-271; etc.

intuition in general; speeds and directions, on the other hand, are *quantities* that respond to the question 'how much.'

The former concept is logically prior inasmuch it first makes possible that an object *has* a quantitative aspect, which is determined, measured and compared through the latter concept.[27] The given construction, we may maintain, reverses this order of priority in order to recount *how* the concept of motion (and hence, the object known through it, i.e., movable matter) is first susceptible to mathematical analysis. Perhaps the switch from the one concept to the other, then, represents an effort to ground the determinate quantity of motion according to speed and direction in a prior understanding of motion as a quantum, as a composition of a homogeneous manifold in intuition. In this way, the quantum-quantity distinction saves Kant's construction from outright circularity, because the different natures of the two quantifying concepts of motion involved in the construction possess an insuperable relation of priority among themselves. Yet, this account remains somewhat unsatisfying because, while it quells the charge of circularity and provides a motive for the 'switch' between different types of concepts, it does not fully explain why things *must* stand thus, i.e., why motion must be seen first with (intensive) quantities of speed and direction and then with its composition per the manifold of homogeneous intuition. To see this, we must connect the analysis carried out so far on a geometrical plane with its grounding moments on a physical one and this is done most conveniently by means of the concept of sensation.

[27] B203: "[T]he consciousness of the homogeneous manifold in intuition in general, insofar as through it the representation of an object first becomes possible, is the concept of a magnitude (*Quanti*)." ("[D]as Bewußtsein des mannigfaltigen Gleichartigen in der Anschauung überhaupt, so fern dadurch die Vorstellung eines Objects zuerst möglich wird, der Begriff einer Größe (*quanti*).")

V. The Reference to Sensation

At one level, the connections between the geometrical and physical registers are obvious from the very structure of the Phoronomy. The Phoronomy first posits the phoronomical concept of matter through reflections on the empirical apprehension of motion, which culminates in the phoronomical principle about the equivalence of relative motions allocated to different entities from the standpoint of experience. Next, this principle is applied in the constructions in order to secure a priori knowledge of the possibility of that phoronomical concept of matter. In other words, the structure of the Phoronomy contains two parts: first, the main moments of the phoronomical concept of matter are laid out, and second, these moments are described in an a priori intuitive framework such that the phoronomical concept can be said to have been constructed; a perfect parallelism between the two is intended. But how do we arrive at the phoronomical concept and principle from the concept of movable matter?

In a passage that we shall return to in Section 7, Kant remarks on the way he is using the given definition of movable matter.[28] He opens the chapter by stating his

[28] MFNS 194-5; Ak.4: 481: "If I am to explicate the concept of matter, not through a predicate that belongs to it itself as object, but only by relation to that cognitive faculty in which the representation can first of all be given to me, then every *object of the outer senses* is matter, and this would be the merely metaphysical explication thereof. Space, however, would be merely the form of all outer sensible intuition (we here leave completely aside the question whether just this form also belongs *in itself* to the outer object we call matter, or remains only in the constitution of our sense). *Matter*, as opposed to *form*, would be that in the outer intuition which is an object of sensation, and thus the properly empirical element of sensible and outer intuition, because it can in no way be given a priori. In all experience something must be sensed, and that is the real of sensible intuition…" ("Wenn ich den Begriff der Materie nicht durch ein Prädicat, was ihr selbst als Object zukommt, sondern nur durch das Verhältniß zum Erkenntnißvermögen, in

definition of movable matter in the relevant phoronomical context (Erklärung 1), and after observing that phoronomy considers matter shorn of all inner characteristics, he explains that the concept of matter at hand will incorporate a reference to sensation. We can distinguish in the empirical concept of matter as an object of outer sense between the form and matter of outer sensible intuitions – the form is space and the matter opposed to such a form is an object of sensation, the real. In Section 7 we will sort through the confusing array of terms thrown together here – form, matter, matter as object of sensation, matter as real in space, etc. For now, however, it is important to note that Kant uses *this* characteristic of sensation as a hallmark of our empirical knowledge, both in general and of matter in the present text. As we saw earlier, Kant goes on from here to derive the concepts of empirical space, relative motion, absolute space, etc., by devising an argument showing infinite regress in the empirical conditions of knowing motion.

Kant's use of sensation as a criterion-characteristic for his further reflections injects unstated premises into this argument. Uncovering such premises sheds light on other unsettling assumptions we have encountered above, e.g., the basis for ascribing

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welchem mir die Vorstellung allererst gegeben werden kann, erklären soll, so ist Materie ein jeder *Gegenstand äußerer Sinne*, und dieses wäre die blos metaphysische Erklärung derselben. Der Raum aber wäre blos die Form aller äußeren sinnlichen Anschauung (ob eben dieselbe auch dem äußeren Object, das wir Materie nennen, an sich selbst zukomme, oder nur in der Beschaffenheit unseres Sinnes bleibe, davon ist hier gar nicht die Frage). Die *Materie* wäre im Gegensatz der Form das, was in der äußeren Anschauung ein Gegenstand der Empfindung ist, folglich das Eigentlich-Empirische der sinnlichen und äußeren Anschauung, weil es gar nicht *a priori* gegeben werden kann. In aller Erfahrung muß etwas empfunden werden, und das ist das Reale der sinnlichen Anschauung…") Why Kant calls this a "metaphysical explication" is a difficult question and related to the questions about his conception of a special metaphysics, which were touched upon in earlier chapters in connection with understanding the place of the *Metaphysical Foundations* in Kant's Critical architectonic. This question will not be pursued here, but see Westphal (2004), 138-141&ff. for more on Kant's 'new' notion of metaphysics as the a priori analysis of empirical concepts. (Although I don't really think 'metaphysics as a priori cognition about empirical concepts/entities' is a 'new' move; the A847-8/B875-6 passage says the same thing too, so what's so new for Westphal? Rather, what is new is this talk of pulling the subjective faculties of representation into the concept – a footnote added in the second edition (cf. B202n) mentions this 'new' present sense of metaphysics in talking of metaphysical (as modal) combination a priori in the *Erkenntnisvermögen*.)

intensive quantities to motion, the 'switch' between quantum and quantity, perception of empirical space, etc. The *Critique of Pure Reason*'s Anticipations of Perception propounds a principle regarding the real as the object of sensation and I suggest that this forms the core of these unstated premises.[29] In the second edition, the principle runs as: "In all appearances the real, which is an object of sensation, has intensive magnitude, i.e., a degree."[30] Roughly, Kant's argument for the principle asserts that sensation, so far as it

[29] That the Anticipations of Perception play a role in Kant's Phoronomy is at first a contentious claim. This is because the Anticipations are principles qua applications of the categories of *Quality* in regard to appearances, whereas the Phoronomy is an application of the categories of *Quantity* to motion as the fundamental determination of matter and the application of Quality should come into play in the second chapter on Dynamics to preserve the correspondence between the table of categories and the arrangement of the *Metaphysical Foundations*. Further, Kant does not mention the Anticipations of Perception in the Phoronomy at all. But, first, as I had explained in my Ch. 1, Section III, it is very hard to defend a strict mapping of the transcendental principles of the pure understanding onto the various metaphysical principles adduced in the present text. Second, while it is true that the Anticipations are not mentioned in the Phoronomy, neither are they really mentioned in the Dynamics either, as should be the case were there a fixed correspondence of transcendental and metaphysical principles. It is also true that the topic of the Dynamics – to explain how matter *fills space* – is more closely connected with the observations Kant makes in the *Critique of Pure Reason* about the hypothesis licensed by his Anticipations in regard to such dynamic filling of space, which would incline one to establish a correspondence of principles by this proximity of topic. Yet it is equally true that the empirical standpoint and the concept of empirical space in the Phoronomy, as I will detail below, talk about the real of sensation, which is rather directly a topic of the Anticipations so far as a formal constitution of appearances is considered in light of sensation. We had already seen in chapter 1 that there really are few grounds to assert a strict architectonic correspondence between the *Critique of Pure Reason* and the *Metaphysical Foundations*, so one cannot give as much due to Kant's systemic concerns as one or even Kant himself would have liked. Finally, I am indeed offering an interpretation through "unstated" premises in Kant's text, so I do not expect the contentiousness of my claim to be ameliorated on the basis of direct textual evidence; I do hope, however, that the substance of my interpretation eases dissatisfaction on those lines.

[30] B20 (I have slightly modified the translation and removed Kant's emphases): "**In allen Erscheinungen hat das Reale, *was ein Gegenstand der Empfindung ist*, intensive Größe**, d.i. einen Grad." The first edition version runs as: "In all appearances the sensation, and the **real**, which corresponds to it in the object (*realitas phaenomenon*), has an **intensive magnitude,** i.e., a degree." (A166: "In allen Erscheinungen hat die Empfindung und das **Reale**, welches ihr an dem Gegenstande entspricht, (*realitas phaenomenon*) eine **intensive Größe**, d.i. einen Grad.") There is, as is typical with things Kantian, no unanimity on how to read the significance of the different statements of the principle in the two editions: Paton ([1936], vol.2) thinks that nothing more than a preference for brevity underlies the change; Buroker ([2006], 150), while working under the same emphasis as Paton that all the principles are occupied with proving objective reference and that a correspondence between the intensive magnitudes of sensation and the real is a key premise of Kant's argument for establishing this reference, does find reason to decide in favor of the A-edition version, since it announces the said correspondence better; for the same reason of clearly setting up the correspondent elements, Guyer ([1987], 197) finds the B-edition version more precise and preferable. My own position on this issue is tied up with my reading of the different proofs of the principle offered by Kant. These, while making the same point, are not entirely consistent with each other

is related to the real in perception, is capable of being represented through a synthesis whereby a determinate magnitude is gradually generated, because any empirical consciousness (of the real) can possibly diminish (in a uniform, gradual, continuous way) to a pure consciousness, where the real is absent and all that remains is the pure manifold of space and time with nothing in them.

Not everything is perfectly clear in this argument, and in the following analyses, I will not defend its overall cogency. For my purpose it is pertinent to examine what its conclusion affirms, namely, that "all objects of perception, insofar as they contain sensation, must be ascribed an **intensive magnitude**,"[31] and what this has to do with the standpoint of Kant's phoronomical reflections on the empirical framework for perceiving motion and sensing matter. It should be evident that the same motivations instruct the ascription of an intensive magnitude to the *movable in space* in the case of Kant's Phoronomy and to the *real as the object of sensation* in the case of Kant's Anticipations.

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in their details, and thus I take the different formulations of the principle as saying the same thing but guiding our examination of the proof differently. E.g., I find the B-version of the principle drawing attention to that aspect of the new proof which now receives stress, namely, the concept of the real as the object of sensation, which I will focus on in my analysis below. This becomes especially clear if we compare the formal conclusion of the proof in the A-edition, which states that "every reality in the appearance has intensive magnitude, i.e., a degree" (A168: "Also hat jede Realität in der Erscheinung intensive Größe, d.i. einen Grad"), with its almost exact re-statement in the B-principle, but for qualifying this reality as the object of sensation, thus guiding our reading of the proof. Longuenesse ([1998], 319-320) also sees no essential difference in the two formulations, except for a similar shift of emphasis as I mention. Yet, our readings diverge in that I see *different* proofs of the same principle, and as I will show, the difference concerns the strategy of inferring the intensive magnitude of the real from the premise about possible variation in sensation, which is downplayed and qualified in the new proof; but Longuenesse finds no such difference and holds the key inference (from variation in sensation to intensive magnitude of the real) constant across different versions (cf. ibid., 311f.n.33).

[31] B208: "…allen Objecten der Wahrnehmung, so fern diese Empfindung enthält, *intensive Größe*… beigelegt werden muß." Intensive magnitudes are defined by contrasting them with extensive magnitudes, which are those "in which the representation of the parts makes possible the representation of the whole (and therefore necessarily precedes the latter)," (A162/B203) thus, the apprehension of an intensive magnitude is one that "does not proceed from the parts to the whole." (A168/B210) Kant also defines an intensive magnitude positively as a "magnitude which can only be apprehended as a unity, and in which multiplicity can only be represented through approximation to negation = 0." (Ibid.)

To this end, we need to know, *first*, more about how the determination of intensive magnitudes relates to knowing extensive magnitudes,[32] and *then*, how this relates to concepts such as movable matter as an object of perception and empirical space as an object of sensation. The following two sections will take up these two issues in turn.

VI. *The Anticipations of Perception*

Kant names the principles of the pure understanding expressed in the Axioms of Intuition and in the Anticipations of Perception together as "mathematical principles."[33] Yet, he assigns to the Axioms a greater office by saying that this "transcendental principle of the mathematics of appearances…*alone* makes pure mathematics in its complete precision applicable to objects of experience."[34] Daniel Sutherland tells us that

[32] We may recall that we first faced this worry at the end of Ch. 1 in reviewing Buchdahl's account of the relation of the principles in the *Critique of Pure Reason* to those in the *Metaphysical Foundations*.

[33] A178/B221: "The preceding two principles, which I named the mathematical ones in consideration of the fact that they justified applying mathematics to appearances, pertained to appearances with regard to their mere possibility, and taught how both their intuition and the real in their perception could be generated in accordance with rules of a mathematical synthesis, hence how in both cases numerical magnitudes and, with them, the determination of the appearance as magnitude, could be used." ("Die vorigen zwei Grundsätze, welche ich die mathematische nannte, in Betracht dessen, daß sie die Mathematik auf Erscheinungen anzuwenden berechtigten, gingen auf Erscheinungen ihrer bloßen Möglichkeit nach und lehrten, wie sie sowohl ihrer Anschauung als dem Realen ihrer Wahrnehmung nach nach Regeln einer mathematischen Synthesis erzeugt werden könnten; daher sowohl bei der einen, als bei der andern die Zahlgrößen und mit ihnen die Bestimmung der Erscheinung als Größe gebraucht werden können.")

[34] A165/B206 (my italics): "Dieser transscendentale Grundsatz der Mathematik der Erscheinungen…ist es *allein*, welcher die reine Mathematik in ihrer ganzen Präcision auf Gegenstände der Erfahrung anwendbar macht."

the Axioms are in fact responsible for *all* knowledge of magnitude,[35] and accordingly, "Kant holds that we cannot even represent an intensive magnitude as a magnitude at all (as containing a homogeneous manifold at all) without the aid of space or time."[36] While Sutherland's observation is restricted to exploring Kant's philosophy of mathematics, we shall see its concern for the dependence of intensive upon extensive magnitudes is central to the very argument-structure of the Anticipations as well.

The representation of any determinate magnitude or quantum requires the transcendental synthesis of the imagination such that the pure manifold of space and/or time may be determined by the understanding. In all appearances so far as they contain an intuition in space and/or time, this happens with the successive synthesis of apprehension itself. The *successiveness* of the synthesis is precisely what explains the extensivity of these magnitudes.[37] But this condition of extensivity does not obtain in the case of the real in appearance: so far as the real as the object of sensation in the appearance is concerned, its apprehension, according to Kant, is 1) *not successive* but instantaneous, and 2) the sensation itself is *not an objective representation* containing an

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[35] "Although Kant calls both the Axioms and Anticipations mathematical principles, and the Anticipations' principle also concerns magnitude, Kant thinks that the Axioms, which correspond to the categories of quantity, are more fundamental to mathematical cognition. The reason is that our cognition of intensive magnitudes is wholly dependent upon our cognition of extensive magnitudes. Indeed, Kant holds that without extensive magnitudes, we would not be able to represent an intensive magnitude as a magnitude at all. That is, I think, what leads Kant to say at the end of the Axioms that it is the Axioms' principle *alone* that makes pure mathematics in its complete precision applicable to objects of experience." (Sutherland [2005], 157 f.n.32)

[36] Sutherland (2004a), 167. Sutherland (2004), 436, attributes the dependence of intensive on extensive magnitudes to representing determinate times alone. Cf. Longuenesse (1998), 312-314.

[37] A163/B204: "[J]ede Erscheinung als Anschauung [ist] eine extensive Größe, indem sie nur durch sukzessive Synthesis (von Teil zu Teil) in der Apprehension erkannt werden kann." Cf. Sutherland (2004), 437-439 (and f.n.43).

intuition in space and/or time. Kant describes these two conditions of the empirical apprehension of the real in appearance in separate arguments occurring in the different editions of the Anticipations:

> A-edition: Apprehension, merely by means of sensation, *fills only an instant*… As something in the appearance, the apprehension of which is *not a successive synthesis*, proceeding from the parts to the whole representation, it therefore has no extensive magnitude… (Italics added).[38]
>
> B-edition: Now since sensation in itself is *not an objective representation*, and in it neither the intuition of space nor that of time is to be encountered, it has, to be sure, no extensive magnitude, but yet it still has a magnitude (and indeed through its apprehension, in which the empirical consciousness can grow *in a certain time* from nothing = 0 to its given measure)… (Italics added).[39]

Aside from the different reasons given for the lack of extensivity (A-edition: instantaneous apprehension through sensation, B-edition: non-objectivity of sensation), the role of the time of apprehension is clearly inconsistent over the two arguments, since the A-edition argument seems to rely on the notion of an instant, a simple with no parts, whereas the B-edition seems to involve the concept of a "certain time," which implies a stretch of time having parts. More importantly, the deeper question of why sensation or the real in appearance must be an intensive magnitude, or before that, even a magnitude at all, is not obvious from the foregoing (although the B-edition simply declares this). To

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[38] A167/B209: "Die Apprehension, bloβ vermittelst der Empfindung, erfüllet nur einen Augenblick… Als etwas in der Erscheinung, dessen Apprehension keine sukzessive Synthesis ist, die von Teilen zur ganzen Vorstellung fortgeht, hat sie also keine extensive Größe…" Kant retains this (step as well as the whole of the) argument with extremely minor touch-ups in the second edition. But since I will examine the differences between this version and the completely new argument he adds in the second edition, I will distinguish them as the A- and B-edition arguments respectively.

[39] B208: "Da nun Empfindung an sich gar keine Objektive Vorstellung ist, und in ihr weder die Anschauung vom Raum, noch von der Zeit, angetroffen wird, so wird ihr zwar keine extensive, aber doch eine Größe (und zwar durch die Apprehension derselben, in welcher das empirische Bewuβtsein in einer gewissen Zeit von nichts = 0 bis zu ihrem gegebenen Maβe erwachsen kann)…"

shed light on this deeper question, let us consider the arguments in both editions more closely. I will now quote them both in full, carving them up for convenience.

A-edition Proof of the principle of the Anticipations (A167-168/B209-210):[40]

(a) "Apprehension, merely by means of sensation, fills only an instant (if I do not take into consideration the succession of many sensations.)

(b) "As something in the appearance, the apprehension of which is not a successive synthesis, proceeding from the parts to the whole representation, it [sensation] therefore has no extensive magnitude; the absence of sensation in the same moment would represent this [moment] as empty, thus = 0.

(c) "Now that in the empirical intuition which corresponds to the sensation is reality (*realitas phaenomenon*); that which corresponds to its absence is negation = 0."

(d) "Now, however, every sensation is capable of a diminution, so that it can decrease and thus gradually disappear.

(e) "Hence between reality in appearance and negation there is a continuous nexus of many possible intermediate sensations, whose difference from one another is always smaller than the difference between the given one and zero, or complete negation.

(f) "That is, the real in appearance always has a magnitude, which is not, however, encountered in apprehension, as this takes place by means of the mere sensation

[40] "Die Apprehension, bloβ vermittelst der Empfindung, erfüllet nur einen Augenblick, (wenn ich nämlich nicht die Sukzession vieler Empfindungen in Betracht ziehe). Als etwas in der Erscheinung, dessen Apprehension keine sukzessive Synthesis ist, die von Teilen zur ganzen Vorstellung fortgeht, hat sie also keine extensive Gröβe; der Mangel der Empfindung in demselben Augenblicke würde diesen als leer vorstellen, mithin = 0. Was nun in der empirischen Anschauung der Empfindung korrespondiert, ist Realität (realitas phaenomenon); was dem Mangel derselben entspricht, Negation = 0. Nun ist aber jede Em|pfindung einer Verringerung fähig, so faβ sie abnehmen, und so allmählich verschwinden kann. Daher ist zwischen Realität in der Erscheinung und Negation ein kontinuierlicher Zusammenhang vieler möglichen Zwischenempfindungen, deren Unterschied von einander immer kleiner ist, als der Unterschied zwischen der gegebenen und dem Zero, oder der gänzlichen Negation. Das ist: das Reale in der Erscheinung hat jederzeit eine Gröβe, welche aber nicht in der Apprehension angetroffenn wird, indem diese vermitellst der bloβen Empfindung in einem Augenblicke und nicht durch sukzessive Synthesis vieler Empfindungen geschieht, und also nicht von den Teilen zum Ganzen geht; es hat also zwar eine Gröβe, aber keine extensive. Nun nenne ich diejenige Gröβe, die nur als Einheit apprehendiert wird, und in welcher die Vielheit nur durch Annäherung zur Negation = 0 vorgestellet werden kann, die **intensive Gröβe**. Also hat jede Realitat in der Erscheinung intensive Gröβe."

in an instant and not through successive synthesis of many sensations, and thus does not proceed from the parts to the whole; it therefore has a magnitude, but not an extensive one.

(g) "Now I call that magnitude which can only be apprehended as a unity, and in which multiplicity can only be represented through approximation to negation = 0, **intensive magnitude**.

(h) "Thus every reality in the appearance has intensive magnitude, i.e., a degree."

B-edition proof of the principle of the Anticipations (B207-208):[41]

(a) "Perception is empirical consciousness, i.e., one in which there is at the same time sensation.

(b) "Appearances, as objects of perception, are not pure (merely formal) intuitions, like space and time (for these cannot be perceived in themselves). They therefore also contain in addition to the intuition the materials for some object in general (through which something existing in space or time is represented), i.e., the real of the sensation, as [*sic*; thus] merely subjective representation, by which one can only be conscious that the subject is affected, and which one relates to an object in general.

[41] "Wahrnehmung ist das empirische Bewuβtsein, d.i. ein solches, in welchem zugleich Empfindung ist. Erscheinungen, als Gegenstände der Wahrnehmung, sind nicht reine (bloβ formale) Anschauungen, wie Raum und Zeit, (denn die können an sich gar nicht wahrgenommen werden). Sie enthalten also über die Anschauung noch die Materien zu irgend einem Objekte überhaupt (wodurch etwas Existierendes im Raume oder der Zeit vorgestellt wird), d.i. das Reale der Empfindung, also bloβ subjective Vorstellung, von der man sich nur bewuβt werden kann, daβ das Subjekt affiziert sei, und die man | auf ein Objekt überhaupt bezieht, in sich. Nun ist vom empirischen Bewuβtsein zum reinen eine stufenartige Veränderung möglich, da das Reale desselben ganz verschwindet, und ein bloβ formales Bewuβtsein (a priori) des Mannigfaltigen im Raum und Zeit übrig bleibt: also auch eine Synthesis der Größenerzeugung einer Empfindung, von ihrem Anfange, der reinen Anschauung = 0, an, bis zu einer beliebigen Größe derselben. Da nun Empfindung an sich gar keine Objektive Vorstellung ist, und in ihr weder die Anschauung vom Raume, noch von der Zeit, angetroffen wird, so wird ihr zwar keine extensive, aber doch eine Größe (und zwar durch die Apprehension derselben, in welcher das empirische Bewuβtsein in einer gewissen Zeit von nichts = 0 bis zu ihrem gegebenen Maβe erwachsen kann), also eine **intensive Größe** zukommen, welcher korrespondierend allen Objekten der Wahrnehmung, so fern diese Empfindung enthält, **intensive Größe**, d.i. ein Grad des Einflusses auf den Sinn, beigelegt werden muβ."

(c) “Now from the empirical consciousness to the pure consciousness a gradual alteration is possible, where the real in the former entirely disappears, and a merely formal (a priori) consciousness of the manifold in space and time remains;

(d) “thus there is also possible a synthesis of the generation of the magnitude of a sensation from its beginning, the pure intuition = 0, to any arbitrary magnitude [of it].

(e) “Now since sensation in itself is not an objective representation, and in it neither the intuition of space nor that of time is to be encountered, it has, to be sure, no extensive magnitude,

(f) “but yet it still has a magnitude (and indeed through its apprehension, in which the empirical consciousness can grow in a certain time from nothing = 0 to its given measure),

(g) “thus it has an **intensive magnitude**, corresponding to which all objects of perception, insofar as they contain sensation, must be ascribed an **intensive magnitude**, i.e., a degree of influence on sense.”

In comparing these two proofs my goal is *not* to install invincible cogency in them; rather, as I said earlier, I am interested in seeing how Kant’s proof ascribes to sensation an intensive magnitude or even a magnitude at all, and how intensive magnitude is shown to depend on extensive ones. In this respect, notice that the A-proof concludes to the real as intensive magnitude *principally* by construing sensation as a magnitude at all in its (d). That is, it proves that the real must have intensive magnitude by means of a claim about sensations being magnitudes; without the latter, there would be no reason for calling the real a magnitude at all, leave alone an intensive one. Premises (b), (c), and (e) in the A-proof provide the framework for precisely this inference *from* the nature of sensation as a magnitude expressed in (d), while (g) with (e) specifies it as an intensive magnitude. Thus, that sensations may or do diminish seems to

license, for Kant, an assertion to the effect that sensations are magnitudes at all, whereas further premises help show what kind of magnitude it must then be.

Now, (d) of the A-proof has been subject to much scrutiny as to its modality and scope – is it a merely logical possible or empirically plausible claim about the nature of sensations or is it a necessary condition on sensations, does it cover every sensation or is knowing this to be true of some sensations enough?[42] The weakest version of (d) towards establishing the magnitude of sensations would contain a combination of two thoughts: (i) I have empirical acquaintance with the capacity of diminishing in regard to only some sensations, and (ii) a magnitude just is something that can diminish (or increase). Clearly, a limited empirical claim such as (i) cannot ground the proof of a transcendental principle. But even if we allow (i), (ii) would end up being quite counter-productive, because the implication of a magnitude from something's diminution would only be restricted to *extensive*, not intensive magnitudes.[43] If the weakest version of (d) faces insurmountable difficulties, one naturally surmises that the harder cases pose yet greater challenges to its truth.

In addition, notice that in examining (d) as that upon which the ascription of magnitude as such to sensations (hence, to the real) principally turns, no use has been made of the further alleged facts about their capacity to "gradually disappear" via "a

[42] Cf. Paton (1936), vol.2, Ch.38, esp. 142-145; Guyer (1987), 198-205 & 443-444 f.n.19; Longuenesse (1998), 313, 314, 319 & f.n.47, 320-321 & f.n.52; etc. As I understand it, this would be a classic example of what Westphal ([2004], Ch.1) elaborates as Kant's "epistemic reflections," although I am not sure what work that bit of nomenclature does in his account so as to extrapolate to the given case.

[43] The idea here is that extensive magnitudes just are those that are put together from prior, homogeneous parts, which may be taken as implying that any determinate extensive magnitude allows of diminution and expansion by adding or subtracting such parts. Cf. Wolff (2001), 216f.n.26, 217f.n.27 & passim for a fascinating development of this idea as underlying Kant's Axioms of Intuition.

continuous nexus of many possible intermediate sensations," and so on. No doubt that Kant believed such a capacity involving *continuous diminution* would fit very well with his definition of intensive magnitudes in the A-proof's (g) as involving the representation of "multiplicity… through *approximation to negation* = 0." But, given how little we do know of this capacity (or, conversely, how much more we need to assume as 'possible' about it), I do not see anything that prevents our supposing that a given limited range of diminutions is also *made to fit* the definition of intensive magnitudes. That is, if we are indeed indulging presumptions about and on the basis of an established albeit limited range of diminutions in sensations, then why not also suppose that this diminution may in fact proceed ever further? No claim to the contrary, e.g., a minimum threshold of intensity for a sensation, has been mentioned that would block this presumption. Hence, even without justifying any full-blown continuity of diminution, we may very well construe the diminution of sensation to count as a case of 'approximating to negation,' and thus as an intensive magnitude per the given definition in (g). In that case, the question becomes: to what further end is the hypothesis of a *continuous* diminution of sensation projected, if it is *not* needed to secure its being an intensive magnitude?[44]

[44] Beatrice Longuenesse (1998) has treated this question in some depth and arrives at conclusions different from what I maintain below, so I will specify the points of divergence. Longuenesse works mainly with the notion that the continuity of sensation, and hence of the real, is a *logically* possible representation (313, 314, 319 & f.n.47, etc.), although she recognizes that there are some Kantian texts that allow for a looser sense of variation in sensations ('lesser' or 'greater' in unquantifiable ways) as to their mental effects (320-321) as well as the fact that the possible representation of a continuous variation is sufficient but not necessary for securing an intensive magnitude for the object of such a representation (314-315). Following Friedman, Longuenesse also believes that "Newton's 'theory of fluxions' is quite clearly what Kant had in mind when he described sensation as something that can increase continuously from zero as well as decrease from zero" (317), which only helps explain Kant's motivations without being a proper justification. Her account seems to provide such justification from three perspectives: (1) time is a continuous magnitude, so sensations represented as filling time should be continuous as well (315, 319); (2) Kant's text at A171-172/B212-213 explains the impossibility of knowing continuity in alteration a priori while accepting the a priori possibility of a continuity of the real (314-316); and (3) the logical form of infinite judgment leads to the category of limitation somehow by way of thinking progressive determination or "gradual limit[ation]" and requires a corresponding "intuitive limitation" on this account

On my present reading, this issue points to the second topic of interest I mentioned earlier, namely, the dependence of intensive upon extensive magnitudes. To see how, reference must be made to Kant's talk of continuity as a property of magnitudes a few lines down from the A-proof. Kant draws a number of corollaries from the proof of his principle, including one about space and time as *quanta continua*.[45] Here, it seems

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(306). *Ad (1)*: it should be said that this approach is open to a serious objection posed by Guyer ([1987], 202) to the effect that nothing about the continuous structure of that which fills time follows from the assertion of the continuity of time. That is, there is no more connection between these two than, as he puts it, "the structure of wine bottles and the fact that what fills them comes in different vintages." Accordingly, even if Kant held such a view, it seems worth rejecting. *Ad (2)*: while it is true that Kant made the said statements, they clearly rely on something like the previous argument in assuming the continuity in the variation of sensation, and thus cannot be put forth as a justification. In any case, in attending to Kant's thought in these statements, Longuenesse aims at extracting deeper connections between the Anticipations and the Analogies of Experience, which go well beyond the scope of my discussion. However, in view of this goal of connecting the Anticipations and Analogies, she reads a connection between the variability of the real of sensation and the continuity of alteration. I think this rests on a misunderstanding of Kant's text, which I explore in (2) of the following footnote in the course of reviewing Guyer's misreading of the same text. It is striking, as I show there, that these (mis)readings of the text rest on overlooking a key sentence in Kant's text itself and both Guyer and Longuenesse (314) elide *precisely* this sentence (marked with "*" in the next footnote) in their quotations of the text. Longuenesse's elision seems deliberate in quoting the *entire* paragraph *except* this sentence. *Ad (3)*: While this is an innovative and compelling line of thought, I am not sure I fully understand Longuenesse's thinking on this topic and remain a tad uncomfortable with how it imports transcendental presuppositions of reason in its ideas (here, that of the complete determination of a thing through the totality of predicates) into the barer framework of the conditions of possibility of experience (here, the schematized category of limitation).

[45] A169-170/B211. The other corollaries explain: (1) the grounding of aggregates having separate parts on a continuous quantum, (2) the prohibition on drawing causal implications a priori about continuous alteration from the mathematical notion of continuity at stake in the 'mathematical' principles, and (3) the possibility of a hypothesis of the dynamical filling of space by matter and the refutation of the hypothesis of a mechanical theory resting on the concepts of empty space and absolutely hard bodies as the only possible hypothesis about matter filling space. I will briefly comment on these in turn:
(1) describes the production of a continuous quantum through successive, productive synthesis and distinguishes it from the production of a number of separate parts through the "*Wiederholung einer immer aufhörenden Synthesis*" (A170/B212) and suggests that the latter presupposes the former, being only a case (of repeated interruption) of the synthesis producing continuous quanta. *If* we could think of instantaneous apprehension (intensive magnitudes) as what goes on in the interrupted synthesis, then this corollary would help establish the dependence of intensive upon extensive magnitudes. But Kant's text does not provide enough grounds to do this, so in my main text above I will treat only the corollary regarding the continuity in space and time as having something to say about that current topic of interest.
(2) has given rise to a misreading (see Guyer [1987], 204), which is brought forward as evidence against continuous variation in sensation as an a priori possibility, so I will say something by way of clarification: Due to empirical principles involved in thinking about the causality of alteration, Kant says (at A171/B212-213) that we cannot infer a continuous alteration in general from the fact that appearances (considered both intensively and extensively) are continuous magnitudes. Guyer takes the latter to include continuous variability in sensation and argues that "surely if the continuity of *alteration in general* rests on an empirical principle, then so must the continuous variability of sensations." (ibid.) Aside from the fact that

that Kant argues for space and time being continuous quantities because their parts are always more spaces and times and they do not eventually culminate in nor can they be put together out of points or instants, which are limits of spaces and times respectively. Kant claims that parts of spaces and times can only be given through their limits in points and instants and that points and instants presuppose that which they delimit; because this is so, any conceivable smallest part still contains a manifold, which means that there is no such thing as a smallest part and another smaller one is still possible.[46] Now, what does this have to do with the dependence of intensive upon extensive magnitudes?

Kant happily treats of the continuity of all alteration as an a priori principle in the unpublished First Introduction of the *Critique of the Power of Judgment* (Kant [2000], 38; Ak.20:237), this is a misunderstanding because: First, Kant is *not* saying that there *is* in fact a continuity in alteration in general *and* that it rests on empirical principles; but rather, that we *cannot* know anything about a continuity in alteration from merely a priori considerations, which even leaves undecided whether there is in fact any continuity of alteration at all in the world. Second, Kant's reason for the claim, which Guyer does not consider, clarifies that Kant does not intend it as a problematic generalization to which one may connect the claim about variation in sensation as a particular consequence, but just the opposite. Kant says we cannot have a priori insight into a cause of (continuous) alteration not merely because we simply lack a priori insight about such a possible cause, but rather, "weil die Veränderlichkeit nur gewisse Bestimmungen der Erscheinungen trifft, welche die Erfahrung lehren kann, *indessen daß ihre Ursache in dem Unveränderlichen anzutreffen ist*." (A171/B213; my italics; * [see previous footnote]) That is, the cause *must* be thought as inalterable to be meaningful, while giving rise to a continuous alteration (change of states); and insofar as *both* causes and their effects, qua appearances, contain a continuity of states under the given corollary, there is no a priori way to think the inalterability of one appearance (cause) with the alterability in the other (effect) as compatible. Thus, *continuity in sensation* (as part of the claim about appearances as continuous magnitudes) may be thought a priori through the principle of the Anticipations, but *continuous alteration in general*, if at all possible, requires recourse to experience. This is surely far from Guyer's claim that if the continuity of alteration in general rests on empirical principles, all the more should the continuity in sensation rest on empirical principles.
(3) is obviously of great interest to Kant since the principle of the Anticipations, if correct, makes room for his dynamical theory of matter. Cf. Edwards (2000), esp. 34-36, 194-195 n.9. Note that Kant's point about the dynamical theory needs variation in *intensive* magnitude *together* with a constant *extensive* magnitude.

[46] A169-170/B211:"Die Eigenschaft der Größen, nach welcher an ihnen kein Teil der kleinmöglichste (kein Teil einfach) ist, heiβt die Kontinuität derselben. Raum und Zeit sind quanta continua, weil kein Teil derselben gegeben werden kann, ohne ihn zwischen Grenzen (Punkten und Augenblicken) einzuschlieβen, mithin nur so, daβ dieser Teil selbst wiederum ein Raum, oder eine Zeit ist. Der Raum besteht also nur aus Räumen, die Zeit aus Zeiten. Punkte und Augenblicke sind nur Grenzen, d.i. bloβe Stellen ihrer Einschränkung; Stellen aber setzen jederzeit jene Anschauungen, die sie beschränken oder bestimmen sollen, voraus, und aus bloβen Stellen, als aus Bestandteilen, die noch vor dem Raume oder der Zeit gegeben werden könnten, kann weder Raum noch Zeit zusammengesetzt werden."

Two things help address this question: First, the present paragraph about space and time as continuous magnitudes (see f.n.46) serves as a preface to the other three corollaries (see f.n.45) inasmuch as all of these operate with the idea of continuous magnitudes as structuring appearances, and in fact, all stress the togetherness of extensive and intensive magnitudes in appearance. Of course, this does not by itself prove the dependence of extensive upon intensive magnitudes in any way, but it signals its vicinity to such a concern. Second, the argument about space and time as continuous magnitudes paraphrased above relies on the claim that *instants* always presuppose the determinate times that are delimited through them. If the *instantaneous* apprehension through sensation somehow leads to attributing to it an intensive magnitude, then it seems equally plausible that the presupposition of determinate times for instants expresses the presupposition of extensive magnitudes for intensive ones.

Now, when we turn to the B-proof of the principle of the Anticipations, we find that precisely these two topics of interest – the worry about the intensive magnitude or even magnitude at all of sensation and the claim about the dependence of intensive upon extensive magnitudes – are finessed, even if this does not rescue the proof as a whole. I will try and show in the following that Kant tries to decrease the burden of his proof from the insecure premise about the variability of sensation, which consequently strengthens the proof overall even if it does not lead us entirely out of the dark. But more importantly for my purposes, it will be evident that Kant's reframing of the proof in the second edition lays much emphasis on the fact that our ascription of intensive magnitude to the real of sensation follows upon the (already accepted) proof of the extensive magnitudes of intuitions in the Axioms of Intuition. This stress on wanting to treat the Axioms of

Intuition and Anticipations of Perception in some sense *jointly* is something that marks Kant's thought after the first edition of the *Critique of Pure Reason*.[47] And as we shall see, this has deep connections with the problems Kant encounters in his Phoronomy, which too tries, as it were, to provide an 'axiomatics of intuition' to ground the sensative framework of empirical motion.

So, let us consider the new proof in the B-edition in some detail now. First, it does not make use of the concept of an instant at all and the B-proof's (e) uses the non-objectivity of sensation to deny extensive magnitudes of it instead. Second, the B-proof does not insist on a continuous alteration of sensation according to magnitude, which would have been the story at the purely subjective level, and instead leaves this aspect to the empirical apprehension at an objective level in its (c) and (f). Whereas we saw earlier that the A-proof derives the intensive magnitude of the real by first construing sensation as a magnitude, the B-proof ascribes magnitude to sensation on the basis of construing the real as a magnitude by way of talking about the magnitude of intuition in (c) and (d). The result of this is to make the notion of a magnitude for sensation dependent on the notion of magnitude for intuitions, of which the principle has already established that they, whether pure or empirical, are always extensive magnitudes (Axioms of Intuition).[48]

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[47] As we have already mentioned, both the Anticipations and the Axioms are together called "mathematical principles" already in the first edition of the *Critique of Pure Reason*. But two remarks by Kant – one added to the second edition of this text (B201-202n.) and another from the 1788 *Critique of Practical Reason* (Kant [1996], 223; Ak.5:104) indicate attempts to make this bond yet faster. Both remarks talk of the categoreal functions behind these two principles as dealing with one class of synthesis (of the homogeneous) when contrasted with the remainder of the principles of the pure understanding, and the specific functions behind the Axioms and the Anticipations are only separated as species of that genus of synthesis (of the homogeneous). In these remarks, Kant seems interested to tie both the Axioms and the Anticipations closer together as species of a single genus, and I think we can read this interest back into the differences between the earlier and later proofs of the Anticipations of Perception.

[48] Despite different versions of the principle of the Axioms, "[b]oth formulations assert that not only empirical, but also pure intuitions, are extensive magnitudes." (Wolff [2001], 215 f.n.7; my trans.)

This becomes clearer by inspecting certain moments of the B-proof occluded in the translation. Three instances are especially relevant: first, the distinction between the "real of sensation" and the "real of consciousness" between premises (b) and (c); second, the subject of ascription of an "arbitrary magnitude" in (d); and third, the subject of the apprehension mentioned in (f). Overlooking the first prevents one from seeing how Kant sets up the correspondence between the 'subjective' and 'objective' sides of the story of magnitudes for the real; being mistaken about the second would present a fatal objection to Kant's proof since he would have in that case already presumed magnitudes for sensation; imprecision about the third is connected with the lack of clarity about the previous point and further removes from view the dependence of intensive upon extensive magnitudes. Let us look at these aspects more closely.

Premises (a) and (b) define the terms of the proof and characterize Kant's sensationistic approach[49] more carefully than in the A-proof. In particular, (b) describes the "real of sensation" (*das Reale der Empfindung*) as material in general for the determination of the object of perception and it is a subjective representation.[50] But this

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[49] I follow Rolf George (1981) in understanding Kant's "sensationism" as the doctrine of non-intentional mental states induced by external impingements upon sense.

[50] That is, the real (thinghood) here is not being treated as itself a determination of an object, e.g., "…everything real, i.e., everything that belongs to the existence of things" (B225: "…alles Realen, d.i. zur Existenz der Dinge Gehörigen"); but as possibly related to an object and actually corresponding to sensation, e.g. "The undetermined object of an empirical intuition is called **appearance**. I call that in the appearance which corresponds to sensation its **matter**" (A22/B34: "Der unbestimmte Gegenstand einer empirischen Anschauung heißt **Erscheinung**. In der Erscheinung nenne ich das, was der Empfindung correspondirt, die **Materie** derselben."); "The **quality** of sensation is always merely empirical and cannot be represented a priori at all (e.g. colors, taste, etc.). But the real, which corresponds to sensations in general…only represents something whose concept in itself contains a being, and does not signify anything except the synthesis in an empirical consciousness in general." (A175-176/B217: "Die **Qualität** der Empfindung ist jederzeit bloß empirisch und kann *a priori* gar nicht vorgestellt werden (z.B. Farben, Geschmack etc.). Aber das Reale, was den Empfindungen überhaupt correspondirt im Gegensatz mit der

concept of the real of sensation is arrived at by abstraction, by taking away what belongs to intuition in the *object of perception*, which, in turn, followed upon the talk of *perception* itself as empirical consciousness in (a). Now, (c) refers back to (a) in talking about empirical consciousness and mentions the real of this consciousness, i.e., where the specifications and abstractions of (b) have not been made. Obviously, the real itself does not change over these premises, but the latter concept of the real is conceptually distinct from the former, inasmuch as the real of consciousness is an unresolved part of the complex of empirical consciousness. If the latter generally involves empirical apprehension in intuition and thus falls under the concept of extensive magnitudes, this allows the former or the real of sensation to derivatively[51] acquire a concept of magnitude as well. One then learns that this magnitude cannot be extensive and hence must be an intensive magnitude.

Putting the point another way helps see the dependence of extensive upon intensive magnitudes implicit in the argument from these premises. Recall the problem discussed in regard to the A-proof's assertion of a magnitude at all for sensations: without first justifying the fact that sensations have magnitude, inferring the intensive magnitude of the real as that which corresponds to sensations would be plain twaddle. So, Kant needs to provide this justification, that is, he needs to show that sensations have

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Negation =0, stellt nur etwas vor, dessen Begriff an sich ein Sein enthält, und bedeutet nichts als die Synthesis in einem empirischen Bewußtsein überhaupt.")

[51] A problem apparently lurks in my attempt to draw a 'dependence' between extensive and 'derivative' intensive magnitudes, since too strong or direct a dependence would generate the contradiction between the same quantity being first held to be extensive and then intensive. But I try in the following to avoid this by distinguishing between the actual possession of an extensive magnitude by an intuition and the possible ascription of an intensive magnitude to its sensative components.

magnitudes on the basis of some prior knowledge. In the B-proof, the said prior knowledge concerns the real, so that Kant affirms magnitude of sensations on the basis of affirming magnitude of the real. But this would be no better than the mistake it would be correcting, if this was done *only* on the basis of a supposed correspondence (i.e., a straightforward definitional equivalence) between sensations and the real, which amounts to affirming magnitudes of sensations or the real with equally little reason. But *if* there is another sense for the concept of the real, that is, other than the correspondence with sensation, then the proposed derivation would not beg the question in this way. I suggest *this* is what the conceptual distinction between the concepts of the real is doing in the B-proof. The wider concept of the real, the real of consciousness, draws upon the production of (extensive) magnitudes of intuition, such that the narrower concept of the real of sensation may be ascribed a magnitude. Of course, Kant's description of the 'prior knowledge' that sheds light on *how* the wider concept of the real 'draws upon the production of magnitude in intuition' is far from perspicuous and involves the claim (c) about a "gradual alteration" from empirical to pure consciousness. But disregarding the truth of (c), we can see how the distinction between the two concepts of the real *would* avoid the question-begging approach of the A-proof in attempting to justify asserting magnitude of the real as object of sensation.

Obviously, the obscurity of the claim in (c) poses the greatest threat to the success of Kant's later proof of the principle of the Anticipations. It promises to replace or at least provide prior grounds for the questionable claim in the earlier proof about the continuous diminution in sensation, which could protect the proof in this its most vulnerable premise. But (c) is no better placed than the claim it is designed to protect and

only defers the question raised in regard to the *diminution of sensation* to the same question in regard to its alleged grounds asserting the *diminution of empirical consciousness*. Kant is fond enough of the idea of 'degrees of consciousness' in (c) to put it to use again in the B-edition of the Paralogisms in a section on the "Refutation of Mendelssohn's proof of the persistence of the soul" (B413-417), so one cannot dismiss it as a temporary aberration. This idea seems open to serious misgivings since, as Paul Guyer points out, the *stufenartige Veränderung* from empirical to pure consciousness implies a confusion of "a difference of *kind* with a difference of *degree*."[52]

I take it that Guyer is pointing to the difference in kind laid down by Kant between sensibility and understanding, which on the Leibnizian view could be thought to be a difference of degree in respect of clarity of consciousness. The Leibnizian could thus hold sensibility to involve confused representations that can be clarified in principle to yield conceptual representations, whereas Kant's distinction between intuitions and concepts is hard and fast and does not allow of such a transition from the one to the other. So, the talk of a gradual transition from empirical to pure consciousness of a spatiotemporal manifold in the present instance, if understood as a transition from concepts to intuitions, undoes Kant's own fundamental rejection of the Leibnizian view. But to read with charity and care, Kant does not speak of a gradual transition from the concept of a thing to its (pure) intuition, but of a transition from empirical to pure

[52] Guyer (1987), 203: "Kant tries to ground the premise of variability [of sensation] by saying that 'from empirical consciousness to pure, a steplike alteration is possible…' […] But surely this a priori argument for the principle of degree proceeds only by committing the very error with which Kant was always taxing his predecessors, namely that of confusing a difference of *kind* with a difference of *degree*… The formal and material components in empirical consciousness – that is, the spatial and temporal forms and the sensory matter – are not different *degrees* of some one thing that can be gradually transformed into the other but are intrinsically different."

consciousness of a manifold in space and time. The latter is not itself a pure intuition but a consciousness of the pure manifold of space and time as a priori intuitions. Clearly, then, Kant's intent is to relate such consciousness back to the consciousness that has already been defined as involving the concept of a quantum in the Axioms of Intuition.[53]

Thus, relevant to my purposes, even if the truth of (c) is uncertain and the B-proof no more successful than the A-proof as a consequence, the B-proof's strategy of establishing the concept of magnitude of the real in consciousness *with reference to* the constitution of empirical as well as pure intuitions as extensive magnitudes is abundantly apparent. This is also supported by considering the two other translation issues I mentioned earlier, which require determining pronominal references in (d) and (f) of the B-proof. The premise (d) states that "thus there is also possible a synthesis of the generation of the magnitude of a sensation from its beginning, the pure intuition = 0, to any arbitrary magnitude [of it; *einer beliebigen Größe derselben*]."[54] If one assumes that the "arbitrary magnitude" refers to sensation, then this would amount to presupposing that sensations have magnitudes at all, which would make the whole train of thought up to (d) redundant, aside from having begged the question about sensations having magnitudes at all, whose possibility itself is under consideration in this premise. Hence, I submit that "*derselben*" refers to "intuition," such that Kant is asserting the possibility of a "synthesis of the generation of the magnitude of a sensation," which ranges over "pure

[53] B203: "Nun ist das Bewuβtsein des mannigfaltigen Gleichartigen in der Anschauung überhaupt, so fern dadurch die Vorstellung eines Objekts zuerst möglich wird, der Begriff einer Größe (*Quanti*)."

[54] Guyer and Wood's translation leaves out "derselben."

intuition = 0" and "any arbitrary magnitude" of *that same* pure intuition, and which is correlated with the synthesis over the latter range according to the Axioms of Intuition.

I also think Kant's talk of "any arbitrary magnitude" in (d) and a "given measure" in (f) is not inconsistent as it appears at first glance and, indeed, helps grasp the same idea. Because the very possibility of *ascription* of magnitude at all to sensation depends on the synthesis of the pure manifold of intuition, the composition of apprehension through sensation *can have* any possible value and thus induces what Kant takes to be a continuous range of magnitudes in sensation. That is, the magnitude of sensation can be ascribed as many or as few parts as one wants and the 'arbitrariness of magnitude' in this instance refers to *this possibility* of ascribing magnitude to sensation. Yet, in each instance of *actual* perception there must be a *certain* value given to this magnitude, because in each such act of perception the synthesis of apprehension of an appearance *as empirical intuition* has been (successively) completed and possesses a determinate (extensive) magnitude. That is, the actual apprehension of an intuition in appearance has determinate limits in space and time, which forces a "given measure" to the composition of apprehension through sensation. This idea – the possibility of a continuous magnitude for sensation along with the actuality of a determinate magnitude – both underlines the dependence of intensive upon extensive magnitudes and also leads to Kant's assertion of continuous magnitudes for appearances in the corollaries mentioned earlier (see f.n. 44).

Therefore, (f) should be read as detailing the possession (in each actual apprehension of an appearance) of a determinate magnitude for the "synthesis of the production of the magnitude of a sensation," the possibility of whose constitution as continuous has been described in (d). The former is what gives a *unity* to the synthesis

and the latter explains the possibility of a *plurality* in it, even though we know from (e) that this synthesis is not a successive generation of the whole from given parts. Consequently, the magnitude of the synthesis of apprehension can be intensive per Kant's definition of such magnitude.[55] Now, (f) follows on (e)'s denial of an *extensive magnitude* to the synthesis per sensation, and states that "it [sensation] still has a magnitude (and indeed through its apprehension, in which the empirical consciousness can grow in a certain time from nothing = 0 to its given measure)." According to my exposition above, I submit that "*its* apprehension" and "*its* given measure" refer to *extensive magnitude*, *whose* apprehension and *whose* given measure explains the possession of a determinate magnitude by the synthesis per sensation. The other natural way of reading the sentence would have us refer a given measure to sensation itself. However, like the similar difficulty in settling on the translation of "*derselben*" in (d), this would beg the question about the unexplained quantitative properties of sensation, which is precisely what has to be explained here and not assumed.

My recommendation has the added advantage of ruling out the (albeit ungrammatical) possibility of attributing a "given measure" to "empirical consciousness."[56] Thus, just as we saw in (c) that Kant is not talking of a gradual

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[55] A168/B210: "Nun nenne ich diejenige Größe, die nur als Einheit apprehendiert wird, und in welcher die Vielheit nur durch Annäherung zur Negation = 0 vorgestellt werden kann, die **intensive Größe**."

[56] Benno Erdmann suggests changing "*ihrem* gegebenen Maße" to "*seinem* gegebenen Maße" in (f), so that this refers to the measure of "das empirische *Bewußtsein*." So far as Erdmann's emendation prohibits assuming that sensations carry in-built given measures, I agree with it, and so far as it allows us to think the measure or determinate extensive magnitude of an appearance *of which* we are empirically conscious, I agree with this too. Still, it leaves ambiguous whether one means the latter or implies some picture of one being roused to consciousness from comatose states = 0 up to a given measure, and hence I believe my reading combines the best of his intentions with the avoidance of this ambiguity.

production of consciousness itself from scratch, but a relatively more plausible change from empirical consciousness in general to the formal consciousness of a pure manifold in space and time – here too, Kant is not describing the growth of consciousness "from nothing = 0 to *its* given measure," but rather, he is talking about a perception coming about actually as a whole, which is contemporaneous with the production of a given, determinate extensive magnitude as far as the object of that perception is concerned. Finally, my reading of (f) removes any incompatibility between the A-proof's invocation of the *instantaneous* synthesis of apprehension through sensation and the talk of "a certain time" in the B-proof's (f). To be sure, the B-proof shies away from using the concept of an instant and we have spoken about this already. Yet, it is worth noting that the non-successiveness of apprehension through sensation (e) is compatible with the concept of an instant. And since my reading of (f), by bringing into view the reference to the apprehension of appearances as to determinate extensive magnitudes, does not confuse the determinate extent of time of *this* synthesis with the synthesis through sensation, it leaves Kant room to use the concept of an instant should he need to do so.

VII. Sensing Matter, Perceiving Motion

With these results, we can return to our point of departure in grappling with Kant's specification of sensation as a criterion for the empirical concept of matter and shed light on Kant's phoronomical explication of movable matter and space as sensed objects of experience. Anticipating what is to come, it can be said that the same shape of

Kant's efforts with the reworked proofs for the Anticipations of Perception recur – not only in the effort to ascribe intensive magnitude to motion, but also in the efforts to craft a dependence of intensive upon determinate extensive magnitude in the concept of empirical space.

The argument for the phoronomical principle, as we may recall, involves the empirical apprehension of motion. The latter implies the apprehension of a space in which this motion is experienced, which Kant calls "empirical space." Further, he holds that this space "as material, is itself movable."[57] As noted often, the premise in the last sentence, *if correct*, contains the seeds of the infinite regress that envelops the experience of motion, because each such movable space is enclosed in another and so on. The global relativity of empirical motion is thereby affirmed, which leads to the phoronomical principle about the equivalence of allocating motions to different entities. The premise in question itself results from the definition of matter as movable, which here universally licenses the inference from materiality to movability.[58] Clearly there is a problem about the scope of this inference and how it extends the assertion of mobility to an empirical realm, since the definition was shown to hold for 'transcendental motion' (the transcendental synthetic acts of the imagination), which was unequivocally distinguished from 'objective motion.'

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[57] MFNS 195; Ak.4: 481: "Dieser [der empirische Raum] aber, als materiell, ist selbst beweglich."

[58] That this premise is an inference from the definition of matter as movable is not made explicit by Kant. But it seems to me very hard to uphold the movability of something material without that prior definition. Without it, we would be merely slipping in an empirical observation about matter's mobility as the basis of Kant's metaphysical project and most of my second chapter tried to show why and how this should be avoided. The fact that Kant's language (see previous footnote) suggests an implicit inference above and at other places also lends support to my view, e.g., MFNS Ak.4:487: "…der Raum selbst [kann], weil er als materiell angenommen wird, wiederum als ruhig oder bewegt vorgestellt werden."

We saw in the previous chapter that this restriction was placed on the concept of motion through the idealist framework of Kant's theory of sense-affection. The restriction was also legitimated by excluding 'objective motion' from the sphere of consideration on account of repeated injunctions against using empirical principles and reminders about the fact that movability as the property of an object can be known only from experience. So, it is troubling that the 'pure' definition of matter as movable is now employed to assert movability of matter in experience. However, Kant seems to meet this objection to an extent in the Phoronomy through a series of maneuvers that ascribe movability to what he calls an "empirical space." I say "to an extent" because it is doubtful if his dynamical concept of matter in the following chapters fully meets this objection. The reason is that the Phoronomy considers matter merely as an analytic subject of the quantum of motion without any inner characteristics of its own.[59] This means that the restriction on the concept of motion would avoid conflict with matter's own inner characteristics as long as they are excluded from consideration, i.e., until the Dynamics elaborates on the quantity of matter itself (and not merely of motion whose analytical subject it is).

I suspect that Kant's strategy of deferring the problem in this way onto the entity called "relative" or "empirical space" does not ultimately work, mostly because the

[59] Kant declares at the outset that, "Since in phoronomy nothing is to be at issue except motion, no other property is here ascribed to the *subject* of motion, namely, matter, aside from *movability*. It can itself so far, therefore, also be considered as a point, and one abstracts in phoronomy from all inner constitution, and therefore also from the quantity of the movable, and concerns oneself only with motion and what can be considered as quantity in motion (speed and direction)." (MFNS 194; Ak.4: 480: "Da in der Phoronomie von nichts als Bewegung geredet werden soll, so wird dem Subject derselben, nämlich der Materie, hier keine andere Eigenschaft beigelegt, als die *Beweglichkeit*. Sie selbst kann also so lange auch für einen Punkt gelten, und man abstrahirt in der Phoronomie von aller innern Beschaffenheit, mithin auch der Größe des Beweglichen, und hat es nur mit der Bewegung und dem, was in dieser als Größe betrachtet werden kann (Geschwindigkeit und Richtung), zu thun.")

concept of empirical space itself is quite unclear in itself. Kant introduces this concept as follows:

> If I am to explicate the concept of matter, not through a predicate that belongs to it itself as object, but only by relation to that cognitive faculty in which the representation can first of all be given to me, then every *object of the outer senses* is matter, and this would be the merely metaphysical explication thereof. Space, however, would be merely the form of all outer sensible intuition (we here leave completely aside the question whether just this form also belongs *in itself* to the outer object we call matter, or remains only in the constitution of our sense). *Matter*, as opposed to *form*, would be that in the outer intuition which is an object of sensation, and thus the properly empirical element of sensible and outer intuition, because it can in no way be given a priori. In all experience something must be sensed, and that is the real of sensible intuition, and therefore the space, in which we are to arrange our experience of motion[s] must also be sensible – that is, it must be designated through what can be sensed – and this, as the totality of all objects of experience, and itself an object of experience, is called *empirical space*.[60]

Kant's thought in this passage may be paraphrased as adhering to an empirical perspective, and in this, developing the concept of empirical space by attending to the form of matter as an object of outer sense. The empirical standpoint is mediated through a reflective gesture, as indicated in the first sentence, and we turn from predicates of matter as culled from the object itself to its character as an outer sensible representation in general. Space is the form of this representation simply on account of the externality

[60] MFNS 194-195; Ak.4: 481: "Wenn ich den Begriff der Materie nicht durch ein Prädikat, was ihr selbst als Objekt zukommt, sondern nur durch das Verhältnis zum Erkenntnisvermögen, in welchem mir die Vorstellung allererst gegeben werden kann, erklären soll, so ist Materie ein jeder *Gegenstand äußerer Sinne*, und dieses wäre die bloβ metaphysische Erklärug derselben. Der Raum aber wäre die Form aller äußeren sinnlichen Anschauung (ob eben dieselbe auch dem äußerern Objekt, das wir Materie nennen, *an sich selbst* zukomme, oder nur in der Beschaffenheit, unseres Sinnes bleibe, davon ist hier gar nicht die Frage). Die *Materie* wäre, im Gegensatz der *Form*, das, was in der äußeren Anschauung ein Gegenstand der Empfindung ist, folglich das Eigentlich-empirische der sinnlichen und äußeren Anschauung, weil es gar nicht a priori gegeben werden kann. In aller Erfahrung muβ etwas empfunden werden, und das ist das Reale der sinnlichen Anschauung, folglich muβ auch der Raum, in welchem wir über die Bewegungen Erfahrung anstellen sollen, empfindbar, d.i. durch das, was empfunden werden kann, bezeichnet sein, und dieser, als der Inbegriff aller Gegenstände der Erfahrung und selbst ein Objekt derselben, heiβt der e*mpirische Raum*."

that characterizes these representations and Kant abstains from committing to the apriority of space as a pure intuition having its seat in subjective sense-constitution, as the Transcendental Aesthetic propounds. As opposed to this formal generality of the representation, about which we do not ask whether it is a predicate of the object itself or only of our subjective sources of cognition, matter as every *object* of such representation is related to the properly empirical given element, namely, sensation.[61]

The question, however, to persist with the reflectively mediated empirical standpoint, is about how space as form partakes of the properly empirical element, the real of sensation in the case of outer sensible intuitions. That matter as itself an object is not in focus has already been said at the outset, since Kant is trying to provide an account that can consider matter as having no inner characteristics, without extension and essentially as a point. Now, Kant's empirical-reflective stance invites us to take the defining characteristic of this abstract matter, namely, its fundamental predicate of motion, and re-think it in terms of an empirical concept of matter.

[61] There is a serious difficulty here in how we understand the term "matter" and Kant seems to slide between "the matter of appearance" and "the appearance of matter." In my discussion, I will take up both possibilities, although clearly Kant would be making a big mistake in taking "matter" in the former sense when he is trying to talk about matter as the outer object in general. As I hope to show, a deeper dilemma looms on the horizon and underwrites this slippage in terminology: *Either* Kant means to talk of the matter of appearance – in which case, the thought of 'empirical space' in connection with *this* matter signifies nothing but a disguised version of the relation of extensive and intensive magnitudes in the way we saw in the last section, *Or* we should look for a more charitable interpretation of "matter" as I do above, but this fares no better; the first horn of this dilemma entails the danger of equating the metaphysical-phoronomical theory of matter with the transcendental theory of the form of nature in general, while the second horn, which I will develop over the next few pages, equally dangerously entails the dependence of the charitable interpretation on the opaque and insecure premise about the variability of sensation upon which the Anticipations itself was made to rest. So, to clarify: a dilemma looms about this point, which I have not developed in the present footnote yet for it to become apparent as one but shall over the next few pages; it specifically concerns our taking Kant to be talking about *either* the 'matter of appearance' *or* the 'appearance of matter'; I will begin with the second of these two terminological options directly above and only return to the former at f.n. 67 and its surrounding main text.

So we do not ask about matter itself as an object, but of matter as the movable: how *this* characteristic, namely, motion, is included in the explication of matter through the properly empirical element, the real of sensation. Therefore, the form of *matter as movable* has to be specified in relation to the properly empirical element or, in Kant's words, this form, i.e., the space "in which we are to arrange our experience of motions…must be designated through what is sensed." This space is said to be an empirical totality of sorts by means of the perplexing description, "totality of all objects of experience and itself an object of experience." The self-including sense of this description would lead to a self-cancellation, if it actually meant to say that an object is given in experience that is a totality of all empirical objects. So Kant should mean something else by this phrase or run the risk of contradiction. Let us pause for a moment and ask about Kant's motivations behind this train of thought, especially since the insistence on the empirical standpoint leads to such a baffling array of ideas.

He naturally wants to capture by it the fact that an experience of motion produces a spatiality of both the thing moved and its surroundings. It is equally clear that he wants to indicate the formal constitution in intuition of this phenomenon so that he can both assert its empirical givenness as well as outline its production of magnitudes. It is clear too that he wants to suppress matter's own presence through all this so that he can go on to construct motion as a quantum on the basis of this imagery of spaces, but also in the immediate context he can hope that this restriction to an *immaterial* imagery is consistent with the restriction of the sense of motion to the synthetic acts of the imagination. And the talk of the real of sensation as indexing empirical space directly hearkens back to the Anticipations of Perception, whereby he can attribute an intensive magnitude to the

'something movable' and this something, which is only a point, can be reconstructed in terms of the extensive magnitude of determinate spaces of motion, exactly as phoronomy requires.[62] Finally, it is obvious that he wants to assert the materiality of empirical space in order to ascribe the recursive function to infinity of enveloping spaces and consequently the relativity of empirical motion. But none of this is actually expressed in the confusing description of the imaged empirical totality of motion above and I submit that Kant's actual text fails to put across his intentions adequately at this juncture.

This means that Kant *cannot* explain how the construction of the concept of motion is rooted in experience and the phoronomical concept of matter remains a merely mathematical exposition. As mentioned earlier, this phoronomical concept may have other uses as a purely mathematical exposition of the composition of motion as such,[63] and in particular, Kant has in mind the application of this concept in regard to the dynamical concept of matter explored in the *Metaphysical Foundation*'s following chapter. The dynamical concept explains matter as it fills space to a determinate extent by ascribing to such a matter certain moving forces, which are themselves determined as such forces only qua causes of the effect of decreasing the motion of something striving

[62] According to the principle of the Anticipations, movable matter (or motion, given the reduction of matter to just a point) so far as it is apprehended in terms of the real of sensation in Kant's passage, must be ascribed an intensive magnitude. If this was right, it would be quite true to say that motion has an intensive magnitude. The discussion of Section 6 also showed that all determination of intensive magnitude (*necessarily* and not just per metric convenience) requires the expression of extensive magnitudes. Hence it would have also been true to express the intensive magnitude of motion in terms of the production of a determinate manifold in intuition in general. On Kant's terms, such determination refers us to the transcendental conditions of determining a manifold in space and/or time, and hence the reference to speeds and directions *as* these determinations would have been fully justified.

[63] MFNS 200; Ak.4: 487: "Denn die Regeln der Verknüpfung der Bewegungen durch physische Ursachen, d.i. Kräfte, lassen sich, ehe *die Grundsätze ihrer Zusammensetzung überhaupt vorher rein mathematisch* zum Grunde gelegt werden, niemals gründlich vortragen." (My italics)

to penetrate this filled space.[64] Kant thinks, and this is problematic, that the 'decrease in motion' is a phoronomically treatable case of the composition of motion as a quantum.[65] It has already been mentioned that there are intrinsic problems endangering the Dynamics; the merely mathematical status of the phoronomical concept now further shuts out any possibility for deriving the sensibly real bases of the dynamical theory of matter even indirectly from the phoronomical concept.

Let us be clear about the nature of the failure I am describing. I am not claiming that Kant's reflections on the experience of motion, which shows motion to be relative, are themselves misplaced. Nor am I claiming that the *mathematical* construction of

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[64] MFNS Ak.4: 496: "*Materie* ist das *Bewegliche*, so fern es einem *Raum erfüllt*…Dieses ist nun die dynamische Erklärung des Begriffs der Materie. Sie setzt die phoronomische voraus, aber tut eine Eigenschaft hinzu, die sich als Ursache auf eine Wirkung bezieht, nämlich das Vermögen, einer Bewegung innerhalb eines gewissen Raumes zu widerstehen… Diese Erfüllung des Raums hält einen gewissen Raum von dem Eindringen irgend eines anderen beweglichen frei…"

[65] MFNS Ak.4: 497: "Das Eindringen in einem Raum…ist eine Bewegung. Der Widerstand gegen Bewegung ist die Ursache der Verminderung oder auch Veränderung derselben in Ruhe. Nun kann mit keiner Bewegung etwas verbunden werden, was sie vermindert oder aufhebt, als eine andere Bewegung eben desselben Beweglichen in entgegengestzter Richtung (Phoron. Lehrs.) Also ist der Widerstand, den eine Materie in dem Raum, den sie erfüllt, allem Eindringen anderer leistet, eine Ursache der Bewegung der letzteren in entgegengesetzter Richtung." There are at least three obvious problems here as Kant transgresses self-imposed limitiations on the phoronomical proposition:
(1) The phoronomical proposition handles motion explicitly and only as a quantum, which is the reason *why* motion is thought of as a combination of motions, i.e., as a combination of homogeneous elements per the definition of quantity. The proposition does *not* and cannot really claim, as the above quoted lines imply, that in general all and every motion can and must only be combined with motion.
(2) The phoronomical proposition does not properly treat of 'increase' or 'decrease' of motion but merely the possibility of thinking a motion as a composition of component motions. It is true that the mere concept of combination allows, or better, does not prohibit thinking increase/decrease in this picture by means of an iterated series of distinct combinations, but the above quoted lines go beyond well this – claiming without justification that the phoronomical talk of resolving a given motion into components is equivalent to the incremental/decremental changes in the composition of motions.
(3) The further use of the phoronomical proposition in this proof as necessarily implying a causal agency is plainly wrong since it is logically possible that motions increase/decrease spontaneously without implicating a 'movable insofar as it fills space' as the *only* possible cause of such change. In addition, phoronomy expressly forbears from thinking any causal connections of motion, restricting itself to merely mathematical combinations as we saw earlier. So, even if a phoronomical picture was, contra hypothesi, admitted to think causal dimensions in this picture, it would still not be up to the task as it would describe a sufficient condition for the increase/decrease of motion and not a necessary one.

motion as a composite is mistaken. What I have claimed, rather, is that there is a gap between the two, which if not overcome leaves the mathematical construction as nothing more than a helpful fiction on the one hand and the experience of motion irrelevant to its metaphysically justified scientific (i.e., mathematical) study on the other. This can be spelled out as follows:

In discussing the geometrical side of the phoronomical story, I tried to show that Kant's justifications of his construction procedure indicated a problematic that was grounded in a theory of intensive magnitudes as dependent upon extensive magnitudes. This dependence has its home in the principle of the Anticipations of Perception, which, in turn, seemed to be at issue in Kant's reflections on the role of sensation in the empirical apprehension of motion. Without relating the empirical-apprehension and geometrical sides of the story, we are left with the circularity I pointed out in the beginning, namely, that Kant presupposes quantitative aspects of motion in presenting a priori the concept of motion as a quantum in intuition. Even though mitigating circumstances can be found for this presupposition (Kant's use of constructability as a criterion for, and the accepted use in physics and common sense of, concepts like *speed* and *direction*), the question as to *why* motion and movable matter should be accorded an intensive magnitude, which compels the specifics of Kant's construction, remains unsolved. It remains unsolved, in other words, as long as we are unable to understand the empirical apprehension of movable matter and its form, empirical space, through sensation, or as designated by the real of sensation. Empirical space remains too opaque a concept to ground the geometrical in the empirical-apprehension story.

The argument *from* empirical apprehension is supposed to lead to the phoronomical principle that states the equivalence of partitioning motions among different entities. Constructing the concept of motion as a quantum is necessary for the proof of this principle because 'partitioning' and 'distributing' motions equivalently involves such a concept. But *why* this concept (of motion as a quantum) would have anything to do with the concept of empirically perceived motion is not understood unless we ascribe a magnitude at all or an intensive magnitude to the latter concept. Merely assuming that motions are quantized through speed and direction is gratuitous and involves assuming something about motion that is not included in the empirical concept of matter, even if we appeal to the latter concept within the bounds of Kant's stipulation that no empirical principles other than it are involved in his theory. Further, the phoronomical principle about the equivalence of distribution requires that not just the body or movable matter but also empirical space can receive its 'part' of a motion. But the notion of empirical space is itself unclear as acknowledged above, and although one can see what Kant wants it to do, namely, function as an embodied form of movable matter that can accordingly itself be a function of motion, his explanation of this notion is hopelessly inadequate to actually affirm this function of it.

One can speculate about the other side of the phoronomical story as well, that is, the account of empirical apprehension of motion on its own terms. Above, I indicated the motives behind such an account and I want to focus on one of these here – the idea of an embodied form as expressed in the concept, "empirical space," and its connection with the concept of matter as movable. Kant's adoption of an empirical standpoint at the start of the Phoronomy is clearly an effort to 'empiricize' the 'formal' concept of movable

matter, to set the latter in relation to that which is given through sensation. I have said that this injects unstated premises into his argument, the core of which is the principle of the Anticipations of Perception. Accordingly, there arise parallel considerations such as the positing of intensive magnitudes and their dependence on extensive magnitudes, which I tried to bring into view in my interpretation. But the very principle was problematic enough in the *Critique of Pure Reason* and Kant's difficulties with the effort to empiricize his formal concept of matter in the Phoronomy are related to those problematic aspects. By virtue of this principle, the assumption of a magnitude at all or intensive magnitude in particular for motion as given through sensation *would* have been justified, yet neither the proof of the principle nor its 'application' in the present case is entirely perspicuous.

Thus, a similar range of considerations is brought forward by Kant's concept of empirical space as well as the principle of the Anticipations, namely, the generation of representations of magnitude for the real of sensation. But let us temporarily suspend support from the thought of the Anticipations in reading Kant's concept of empirical space and look afresh at the passage quoted above in which Kant introduces the latter concept. Let us take Kant's empirically minded claim about space as a form of the object of outer sense in a stronger sense as maintaining that space is a *formal property* of this object.[66] "Matter" in regard to the same object would then stand for its *material property*

[66] This is actually an overstatement of what I said in my earlier exegesis of this passage. Earlier, I said that space as the formal aspect of the object of *outer* sense merely highlights the *externality* already accorded to it. Now I am reading this formal aspect as a property ascribed to the object, even though Kant wants us to remain agnostic about the true whereabouts of this property, its subjective or objective origins. Kant himself is not averse to such a reading, as can be seen from his account of the "present business" of the Phoronomy, "in welchem wir den Raum ganz notwendig als *Eigenschaft* der Dinge, die wir in Betrachtung ziehen, nämlich *körperlicher Wesen*, behandeln müssen, weil diese selbst nur Erscheinung äußerer Sinne sind und nur als solche erklärt zu werden bedürfen." (MFNS 198; Ak.4: 484) The 'necessity' mentioned here might seem an overstatement of what Kant *can* legitimately maintain about the

indexed through the empirical element of sensation.[67] Using the definition of matter as movable to flesh out this material property forces two thoughts upon this account: (1) matter as movable is indexed through sensation just because the material property is so indexed, and as a consequence, (2) matter as movable is *experienced in space* because, on the one hand, the relation to sensation is a necessary characteristic of *experience* and because, on the other, the material property stands in a necessary complementary relation to the formal property, i.e., *having spatial predicates*.

Accordingly, since the Phoronomy can ignore matter's own inner characteristics and consider matter only as a function of motion, (2) may be restated as involving the thought of "the space, in which we are to arrange our experience of motions" or "empirical space" in Kant's words. Notice, however, that the essential content of this thought is the relation of what I have called the *formal property* to what I have called the *material property*. That is, ignoring the imperfections I have pointed out in this account, what is being posited is the relation between the totality of empirical predicates of spatiality as the formal property of all outer intuitions and the fact that the object of sensation as such constitutes the material property of these intuitions. (*This*, to an extent, approaches the terms of Kant's description of the content of the concept of empirical space as "the totality of all objects of experience, and itself an object of experience.")

"empirical reality" of space (while abstracting from its transcendental ideality), namely, the validity of ascribing spatial predicates to things only if these things are taken in the empirical attitude as appearances. (On the "empirical reality of space," see A27-28/B43-44.)

[67] This way of viewing "matter" is obviously not right because it breaks up the object = matter into its parts = formal + non-formal properties, and identifies the non-formal, material part with the object = matter again. I indicated this difficulty in Kant's account earlier (cf. f.n. 61 above) and the shift in the term "matter" in the sense of "object of outer appearance" to "content of representation" hidden in it, but let us allow it to stand for the moment for the sake of the further argument.

But this appears to be, again, a version of the relation between the formal constitution of an appearance through space (and/or time) and the real as the object of sensation, upon which the principle of the Anticipations turns.

VIII. Consequences and Conjectures

On this reading, therefore, the concept of empirical space seems to recall precisely the main idea of the Anticipations: positing a relation between the real of sensation and the formal constitution of an appearance along with the related dependence of intensive upon extensive magnitudes. In other words, Kant's account of empirical space, if the Phoronomy were indeed to provide proof of the a priori possibility of this concept through construction, would go some distance towards *establishing* the principle of the Anticipations of Perception. This would of course upset Kant's architectonic separations between the transcendental and metaphysical domains of inquiry. And, if such an argument goes through, while relying at the same time on a premise about the necessity of empirical perception, it can perhaps function as an argument "for (not from)" mental content externalism in the manner of Kenneth Westphal's interpretation. In any case, the intimacy of both readings of the concept of empirical space – my most recent reading of it (as confusing the appearance of matter with the matter of appearance) as well as my earlier reading of this concept (as an 'empiricization' of the formal transcendental synthesis in space) – with the topic of producing a concept of magnitude for the real of sensation, or even of just establishing an a priori connection between the formal and

material components of (outer) appearance, is undeniable. This permits certain conjectures, which I will briefly remark upon below.

The problems in Kant's theory stem from his choosing to define matter through motion (PS) in the sense of the transcendental synthesis of the imagination, the *synthesis speciosa*. A gap remains between this sense of motion and the empirical apprehension of motion as a property of objects. In my reconstruction of Kant's definition in the previous chapter, we saw that the concept of motion was perched precariously between its status as a predicable and as a quasi-schema. The problems consequent upon the use of this definition as seen in this chapter compel re-thinking this scenario. With respect to the concept of movable matter in this definition, the two main problems discussed above concern the dependence of intensive upon extensive magnitudes and the role of sensation in the objective apprehension of appearance. In addition, we saw that Kant's defense of the principle of the Anticipations turns on an obscure premise about the "gradual transition" from empirical consciousness in general to the consciousness of a pure manifold in space and/or time.

To posit the intensive magnitude for matter as a function of motion by virtue of its being an object of sensation, we need the principle of the Anticipations of Perception. But this principle itself is not fully secure as to its grounds and the empirical concept of space that is to mediate between this principle and movable matter as such is not altogether coherent in itself. On the other hand, to treat the empirical concept of space as developing the experience of movable matter and to prove the a priori possibility of such a concept through construction implies justifying the transcendental principle of the Anticipations of Perception in respect of outer appearances from metaphysical grounds.

A third possibility would be to simply admit that the concept of motion in question cannot be a pure concept but just an empirical principle, or at least to admit that the pure concept has no relevance for the special metaphysical science of outer objects. But this would incur the charge of offering merely useful mathematical manipulation of assumed entities and would show Kant's claim of providing metaphysical justifications for the foundational assumptions of mathematical physicists as well meant but in the end entirely nugatory. Thus, none of these strategies is immediately appealing.

If Kant does think a metaphysical explanation is in order, then he has to either think a different concept of motion and its connection with matter, or he has to sort out the difficulties of mediating between his given concept of matter as movable and the experience of motion. Perhaps Kant re-imagines the concepts of matter and motion from the ground up elsewhere, but on the present terrain he must confront these difficulties. The crux of these difficulties is his refusal to countenance outer, transcendental affection squarely. In place of outer affection, an obviously central element in the experience of outer objectivity required for the conceptualization of matter, Kant hopes to get by upon the derivative terms of self-affection. That is to say, transcendental idealism treats the crucial external character of matter in internalist terms of self-affection.

This has its charms for he can deploy his account of *synthesis speciosa* with its purchase on a priori formalizations of experience and the co-dependence of spatial and temporal components toward a pure theory of motion.[68] Kant's belief in the intrinsic

[68] Thus, even though the perception of the movable is an intrinsically empirical event and as such a presupposition for the co-dependence of space and time as pure forms (A41/B58: "[D]ie transzendentale Aesthetik nicht mehr, als diese zwei Elemente, nämlich Raum und Zeit, enthalten könne, ist daraus klar, weil alle andre zur Sinnlichkeit gehörige Begriffe, selbst der der Bewegung, welcher beide Stücke vereinigt, etwas Empirisches voraussetzen. Denn diese setzt die Wahrnehmung von etwas Beweglichen voraus. Im Raum, an sich selbst betrachtet, ist aber nicht Bewegliches: Daher das Bewegliche etwas sein muβ, **was im Raum nur durch Erfahrung** gefunden wird, mithin ein empirisches Datum"), Kant can still

non-objectivity of sensation aids this view, since as non-objective and bereft of intuitive determinations sensations are indifferent to spatial or temporal characterization, and yet their relation in general to objects can be formalized in terms of determinate intuitive magnitudes, as the Anticipations tries to show. Yet, the empirical apprehension of motion and the entire train of thought aiming at the empiricization of the formal concept of matter as movable needs specifically outer affection to go through. Otherwise, the discourse from sensation in the concept of empirical space remains a story about the matter of appearance in general and not the appearance of matter, the given object of outer sense, of the real as such and not the real in space. Kant, therefore, must institute a robust account of outer affection to separate the theory of matter from the Anticipations of Perception.

For this he should provide a theory of sensation as a condition of our experience of outer objects, a theory he has not provided even in its rudiments as we said in the previous chapter. Alternatively, or even together with such a theory of sensation, Kant could give up his architectonic allegiances and launch an argument that combines the principle of the Anticipations of Perception and the phoronomical explication to elucidate the conditions of constitution of appearances according to their real-content. By incorporating a theory of sensation at its heart, this approach would have the strength of also grounding the uncertain premises about sensation as having magnitude in the argument for the Anticipations. The advantage of generality contained in the latter argument, however, would have to be sacrificed if the metaphysical explication only

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hope for a *pure* doctrine of motion that elucidates the a priori figurative syntheses of these forms with respect to the form of experience.

concerned itself with sensation as produced through outer appearances. But I do not see much of a loss in this regard, since a discourse of inner sensations would belong to a physiology of inner sense that is incapable of any pure formalization in any case. And Kant's discourse of feelings as subjective states as such should suffice for any other purposes and can be deployed towards a critique of the faculty of judgment, if one wants.

But these are idle speculations; let us turn in the following chapter to see how Hegel is sensitive to just the difficulties mentioned here and how he proposes a solution. The crux of his complaint against Kant's *Metaphysical Foundations* is that its point of departure is defective insofar as it sets out from premises resting upon *sensations* (of matter) to devise a *rational* account (of matter). The crux of Hegel's own suggestion is a directive to explore the *unity of space and time in motion*, which would indicate a revised account of those transcendental idealist, internalist, self-affective impulses we saw at play in Kant's theory of matter as a doctrine of motion and which we saw lead to several difficulties. How these suggestions are to be fleshed out, how Hegel can indeed be seen not as Kant's worst enemy but as his best friend at this point, that is, read as not superficially dismissing Kant's theories or equally superficially imposing revisions upon them, but as reimagining a conceptual framework that works closely with the problems and promises of Kant's own in order to save it from the impasses recounted in this chapter – this is the job of the following chapter.

Chapter 4:

Conclusion: Hegel's Criticism of Kant's Theory

In this chapter I will trace the critical developments of the problematic of Kant's theory of natural science as it has been laid out over the last two chapters. In gist, the problematic has shown itself to be concerned with Kant's claim about the connection of matter and motion as the starting point of his theory of natural science and its entanglements in an underspecified account of the empirical foundations of such a connection. In this chapter, I will work into the picture drawn so far the far-reaching criticisms brought forward against it by Hegel. This will not only show how the latter's own work is deeply cognizant of the problematic in question and shaped by it in fundamental ways, but this will also enable us to put together Hegel's suggestions for overcoming this problematic into a coherent Kantian framework. We can use the latter as a criterial guide to read Kant's own development of the problematic in various ways in his later texts as well as to read its persistence and further development into later post-Kantian thinkers as well.[1]

Hegel's general criticisms of Kant's philosophical approach are too well known to recite here. Moreover, they often give the impression of being facile complaints drawn in large gestures, which only betray Hegel's laziness in not reading Kant's texts to the letter

[1] I will not be able to detail the last two in my dissertation, but the essential basis for that project will be established in this chapter.

and in allowing himself all too easy reflections upon a spirit to be found in them in supposedly more evident ways. I will argue that this is not true and there is a way to read Hegel that shows him to be Kant's most attentive reader. I will show that Hegel understands precisely the problems articulated in the last two chapters and offers constructive criticisms in response to them. In this, his aim is not to dismiss out of hand the Kantian attempt to theorize about a rational physics, but rather, to locate the precise problems in that theory and provide a series of recommendations that would alleviate them *while* working roughly within the Kantian outlook. In general, Hegel wants to show that the various problems stem from Kant's preferred method of "construction," which is actually an imperfect and naïve precursor to his own dialectical method of unraveling the concretion of conceptual forms. For Hegel, the fundaments of rational physics have to be secured not by imitating mathematical procedures and slapping a thin coat of quasi-transcendental psychological observations upon them, but rather the claim of a Kantian rational physics has to be rescued from that erroneous methodology and set on a correct dialectical footing for which certain key innovations have to be first put in place.

I will take up Hegel's specific criticisms of the *Metaphysical Foundations* as they are clearly expressed at two places in his writings: one is a section of his *Science of Logic*[2] that remarks upon Kant's use of forces as an empirical datum for establishing a

[2] I will maintain the following conventions throughout: I will refer to the first part of Hegel's *Encyclopaedia* as the "Encyclopaedia Logic" (in citations, abbreviated as **EL**) or as the "Lesser Logic" while referring to his *Science of Logic* as I have done above. Since the latter, ignoring details, is more or less an expanded version of the former, I may want to talk of the two together and in that case I will use the capitalized "Logic" to refer to Hegel's main texts on logic as a whole. If I do not capitalize "logic," then I am using it in the ordinary sense of the term as I just did in the previous sentence. "Realphilosophie" will refer as usual to the sum of *Philosophy of Nature* (in citations, abbreviated **EN**) and *Philosophy of Spirit* (or *Philosophy of Mind*; in citations, abbreviated **ES**) aside from the Logic. References to the *Science of Logic* will provide the pagination in the English translation followed by the volume and page numbers of the Theorie-Werkausgabe edition (Hegel [1970]; abbreviated as **TWA**); references to EL, EN, and ES will provide the paragraph number (followed by "**R**" for Remark and "**Z**" for Zusatz if applicable) followed by

theory of physics and the inadequacy of Kant's sensationist perspective through this (Section I), and another is a section in his *Philosophy of Nature* that situates the same criticism in the context of Hegel's own theory of the connection of matter and motion and its grounds in the immanent dialectic of the forms of space and time (Section II). Next, I will connect with these criticisms Hegel's improvements on the problematic components of Kant's transcendental-psychological framework, such as the contribution of the object of sensation towards a physical theory and the internalist assumptions regarding transcendental affection from outer objects (Section III). Hegel's speculations on this topic are contained mainly in the chapters on Phenomenology and Psychology in Hegel's *Philosophy of Spirit*, which I think are some of the most sustained and deepest (if at times baffling) reflections upon Kant's doctrine of the three-fold syntheses in the A-edition of the Transcendental Deduction (or equivalently, the B-edition's doctrine of *synthesis speciosa*) and the role of sensation in a priori cognition.[3] Hegel's interpretation of the immanently reflective processes at work in the subject amounts to a radical overhaul of the Kantian theory of the imagination insofar as the latter, as the previous chapters have argued, is crucially involved in setting up the metaphysical grounds of natural science.

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the volume and page numbers of the TWA; I rely upon Hegel (1991), Hegel (1970a) and Hegel (1971) for the English translations of EL, EN, and ES respectively.

[3] I am ignoring the historical question whether Hegel had access to the 2nd edition of the *Critique of Pure Reason* alone or not; Cf. Westphal (1996), 35n.7 & 40n.45.

I. On Kant's construction of matter from forces (*Science of Logic*)

In a remark that is interestingly situated at the cusp of the categories of quality and quantity in the logic of being (*Sein*),[4] Hegel takes issue with the Kantian philosophy of nature as an attempt to construct matter from forces. Although he points out several problems in Kant's account, Hegel thinks that this account indeed serves to advance natural scientific investigation by putting it on a rational and speculative footing. However, Kant's approach falls prey in the end to its empiricist orientation that has no place in such a venture of establishing the true rational grounds of natural science. The praise and criticism are ostensibly directed to the Dynamics chapter of the *Metaphysical Foundations* alone, but I shall show over the course of this and the following sections that this would be an incomplete appreciation of Hegel's point. Rather, for a more complete picture, Hegel's reflections can and should be broadened, on the one hand, to encompass what we have seen of Kant's Phoronomy and its underlying transcendental assumptions, and on the other, to bring into view Hegel's discussions of the relevant themes in his own

[4] This is interesting because major problems in Kant's theory, as mentioned earlier, concern the (illegitmacy of the) transition from a quantitative-phoronomical account of matter to a qualitative-dynamical one, or, if we think back to the source of these problems in the Anticipations of Perception, as I have done, then too it seems like an interesting choice given that this principle seems to recommend adjoining quantitative characteristics a priori to qualitative ones. Hegel's choice of positioning his Remark at the transition between the logical categories of quality and quantity may be read as indicating these concerns and anticipating his own improvements for a rational-physical theory in these regards.

theories of mechanics and psychology. The present section, in any case, remains within the restricted context of Hegel's estimates of Kant's Dynamics, of which he says:

> Kant, as we know, *constructed* matter from the forces of attraction and repulsion, or at least he has, to use his own words, set up the metaphysical elements of this construction… This *metaphysical* exposition of an object which not only itself but also in its determinations seemed to belong only to *experience* is noteworthy, partly because as a conceptual experiment it at least gave the impulse to the more recent philosophy of nature, to a philosophy which does not make nature as given in sense-perception the basis of science, but which discerns its determinations in the absolute concept; and partly because in many cases no advance is made beyond the Kantian construction which is held to be a philosophical beginning and foundation for physics.[5]

I take Hegel to be alert to the niceties of the Kantian program elaborated earlier. He commends it for giving an impetus to a properly rational analysis of nature by means of a metaphysical exposition of matter. In this, he is aware of the distinction between the empirical and general concept of matter in describing the object of Kant's inquiry as *both* taken by itself *as well as* in respect of its determinations. We saw that the former evokes the givenness of matter as an empirical object whereas determinations of matter in general stem from categoreal specifications, and Hegel's reading is alive to this distinction. Hegel certainly has Schelling's *System of Transcendental Idealism* in mind as a "recent philosophy of nature" that does not draw the givenness or predications of

[5] Hegel (1969), 179; TWA 5:201(translation modified): "Kant hat bekanntlich die Materie aus der Repulsiv und Attraktiv Kraft konstruirt oder wenigstens, wie er sich ausdrückt, die metaphysischen Elemente dieser Konstruction aufgestellt... Diese metaphysische Darstellung eines Gegenstandes, der nicht nur selbst, sondern in seinen Bestimmungen, nur der Erfahrung anzugehören schien, ist eines Theils dadurch merkwürdig, daß sie als ein Versuch des Begriffs wenigstens den Anstoß zur neueren Naturphilosophie gegeben hat,--der Philosophie, welche die Natur nicht als ein der Wahrnehmung sinnlich Gegebenes zum Grunde der Wissenschaft macht, sondern ihre Bestimmungen aus dem absoluten Begriffe erkennt; andern Theils auch, weil bei jener Kantischen Konstruktion noch häufig stehen geblieben und sie für einen philosophischen Anfang und Grundlage der Physik gehalten wird." I am very grateful to Prof. George di Giovanni for his help with the meaning and translation of this passage.

matter from experience, but rather, draws upon the 'absolute concept' as a source, which roughly indicates speculative principles of self-consciousness constituting and constituted by those categories. Importantly, Hegel laments that *this* philosophizing merely abides by Kantian constructions, thus suggesting the inadequacy of precisely the metaphysical principles of construction and their repair through speculative principles. This encourages the view that Hegel's recommendations are directly pertinent to problems in the Kantian program and target them through their own specific maneuvers. That is, we should expect a precisely articulated evaluation and not just a general airing of dissatisfaction from Hegel's text.

According to Hegel, the germ of a properly rational investigation of (external) nature is contained in Kant's attempt to construct matter from the opposition of two forces. This attempt itself relies on the thought of the immanent connection of matter and motion, which dispenses with a mechanistic standpoint that starts with the indifference of both to each other and conceives of all action relating the two as externally induced. For Hegel, such a standpoint remains tied to the unthought presuppositions of ordinary mechanics without comprehending their underlying rational structure and necessity. On the other hand, the appeal of a dynamical construction of matter from the interaction of forces lies precisely in leading towards such a rational structure, inasmuch as Hegel construes a *fundamental opposition* of the sort held by Kant as enclosing a certain dialectical relation and justification. (How this dialectical relation is itself grounded in a theory of space and time as natural entities is not pursued by Hegel here but in his *Philosophy of Nature*, which I will consider in the following section.) Let us hear Hegel's diagnosis at length:

> [T]he fundamental thought, namely, the derivation of matter from these two opposite determinations as its fundamental forces, must always be highly esteemed. Kant is chiefly concerned to banish the vulgar mechanistic mode of representation which stops short at the one determination of impenetrability, of *self-subsistent puncticity*, and converts into something *external* the opposite determination, the *relation* of matter within itself or the relation of a plurality of matters, which in turn are regarded as singular ones—a mode of representation which, as Kant says, will admit no moving forces except pressure and thrust, that is, only an effectuation from without. This *external* way of knowing presupposes motion as always already externally *present* in matter, and it does not occur to it to regard motion as something immanent and to comprehend motion itself in matter, which latter is thus assumed as, on its own account motionless and inert. This standpoint has before it only ordinary mechanics, not immanent and free motion.[6]

To understand better what, according to Hegel, Kant got right and what went wrong, and how this is relevant to my purposes, we need to take up the details of his long Remark. As mentioned, Hegel's direct object of concern is Kant's Dynamics chapter in the *Metaphysical Foundations*, which we have only considered in passing until now. In this chapter, Kant works with the definition of matter as a movable that *fills space* as distinct from merely *occupying* it, where filling space (*Raum erfüllen*) is interpreted as an *effect* upon another movable (as a resistance to the motion of another body that seeks to enter such a space), while occupying space (*Raum einnehmen*) is a *non-efficacious* form

[6] Hegel (1969), 181; TWA 5:203-204 (translation modified): "…ist der Grundgedanke immer sehr zu schätzen, die Materie aus diesen zwei entgegengesetzten Bestimmungen als ihren Grundkräften zu erkennen. Es ist Kant vornehmlich um die Verbannung der gemein-mechanischen Vorstellungsweise zu thun, die bei der einen Bestimmung, der Undurchdringlichkeit, *der für-sich-seienden Punktualität*, stehenbleibt, und die entgegengesetzte Bestimmung, die *Beziehung* der Materie in sich oder mehrerer Materien, die wieder als besondere Eins angesehen werden, aufeinander, zu etwas *Äußerlichem* macht;--die Vorstellungsweise, welche, wie Kant sagt, sonst keine bewegenden Kräfte, als nur durch Druck und Stoß, also nur durch Einwirkung von Aussen, einräumen will. Diese *Äußerlichkeit* des Erkennens setzt die Bewegung immer schon als der Materie äußerlich *vorhanden* voraus, und denkt nicht daran, sie als etwas Innerliches zu fassen, und sie selbst in der Materie zu begreifen, welche eben damit für sich als bewegungslos und als träge angenommen wird. Dieser Standpunkt hat nur die gemeine Mechanik, nicht die immanente und freie Bewegung vor sich."

of spatial presence.[7] Kant's exposition of the object of this definition, the dynamical concept of matter, yields the notion of matter as constituted through the interplay of the two opposed forces, repulsive and attractive. The repulsive force is accorded a certain primacy because the concept of matter as filling space and hence repelling another's intrusion into this space immediately proves such a force. The proof of this claim actually stretches over several propositions and explications but its kernel is contained in the proof of *Lehrsatz 1*, which is afflicted with many problems as noted earlier.[8] Subsequently, the attractive force is seen to be equally necessary to the concept of matter as filling (a determinate) space. In sum, then, the dynamical concept of matter as filling space is explained through the interplay of these and only these two fundamental forces.

All that remains to be done, then, for Kant's dynamical concept of matter to go through is to *construct* this concept according to the elements of the dynamical concept explicated so far, thus fulfilling his special-metaphysical methodological requirements.

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[7] MFNS Ak.4:496: "*Materie* ist das *Bewegliche*, so fern es einen *Raum erfüllt*. Einen Raum *erfüllen*, heiβt allem Beweglichen widerstehen, das durch seine Bewegung in einen gewissen Raum einzudringen bestrebt ist." MFNS Ak.4:497: "Man bedient sich des Worts: einen Raum einnehmen, d.i. in allen Punkten desselben unmittelbar gegewärtig sein, um die *Ausdehnung* eines Dinges im Raume dadurch zu bezeichnen. Weil aber in diesem Begriff nicht bestimmt ist, welche Wirkung oder *ob gar überall eine Wirkung aus dieser Gegenwart entspringe* [my italics], ob andern zu widerstehen, die hineinzudringen bestrebt sein, oder ob es bloβ einen Raum ohne Materie bedeute, so fern er ein Inbegriff mehrere Räume ist, wie man von jeder geometrischen Figur sagen kann, sie nimmt einen Raum ein (sie ist ausgedehnt), oder ob wohl gar im Raume etwas sei, was ein anderes Bewegliche nötigt, tiefer in denselben einzudringen (anders anzieht), weil, sage ich, durch den Begriff des Einnehmen eines Raumes dieses alles unbestimmt ist, so ist: *einen Raum erfüllen*, eine nähere Bestimmung des Begriffs: einen Raum *einnehmen*."

[8] MFNS Ak.4: 497: "Lehrsatz 1. Die Materie erfüllt einen Raum, nicht durch ihre bloβe Existenz, sondern durch eine *besondere bewegende Kraft*." This "particular moving force" is qualified as a repulsive force in Lehrsatz 2 (MFNS Ak.4:499), which is held to be a fundamental force according to the Zusatz to Erklärung 2 (ibid.). Over the next several propositions and clarifications Kant specifies various aspects of this force such as elasticity, expansion and compression, contests of forces, its distinction from, relation to, and conceptual priority vis-à-vis the second type of fundamental forces, etc. These specifications, to put it mildly, are not entirely consistent over whether matter as the subject of this force is treated as a point or as an extended quantity in space, although Kant clearly aims at the latter. In any case, the point of departure for ascribing a force of this repulsive type to matter at all is expressed in Lehrsatz 1, which is quoted here and whose Proof was criticized in my Ch.3, f.n.65 (and surrounding main text).

Bizarrely, however, Kant tells us that he cannot provide such a construction. Instead, he makes all sorts of excuses about how "carrying out" the construction itself really belongs to the mathematical domain, while the metaphysician ought to be amply satisfied with the presentation of the "elements of the construction":

> From this original attractive force, as a penetrating force exerted by all matter, and hence in proportion to its quantity, and extending its action to all matter at all possible distances, it should now be possible, in combination with the force counteracting it, namely, repulsive force, to derive the limitation of the latter, and thus the possibility of a space filled to a determinate degree. And *thus the dynamical concept of matter, as that of the movable filling its space (to a determinate degree), would be constructed.* But for this one needs a law of the ratio of both the original attraction and repulsion at various distances of matter and its parts from one another, which, since it now rests simply on the difference in direction of these two forces (where a point is driven either to approach others or to move away from them), and on the magnitude of the space into which each of these forces diffuses at various distances, is *a purely mathematical task, which no longer belongs to metaphysics – nor is metaphysics responsible if the attempt to construct the concept of matter in this way should perhaps not succeed. For it is responsible only for the correctness of the elements of the construction granted to our rational cognition, not for the insufficiency and limits of our reason in carrying it out.* (My italics)[9]
>
> [I]f the material itself is transformed into fundamental forces (whose laws we cannot determine a priori, and are even less capable of enumerating reliably a manifold of such forces sufficient for explaining the specific variety of matter),

[9] MFNS 227-228; Ak.4: 517-518: "Aus dieser ursprünglichen Anziehungskraft, als einer durchdringenden, von aller Materie, mithin in Proportion der Quantität derselben, ausgeübten, und auf alle Materie, in alle mögliche Weiten, ihre Wirkung erstreckenden Kraft, müβte nun, in Verbindung mit der ihr entgegenwirkenden, nämlich zurücktreibenden Kraft, die Einschränkung der letzteren, mithin die Möglichkeit eines in einem bestimmten Grade erfüllten Raumes, abgeleitet werden können, und so würde der dynamische Begriff der Materie, als des Beweglichen, das seinen Raum (in bestimmtem Grade) erfüllt, konstruiert werden. Aber hierzu bedarf man eines Gesetzes des Verhältnisses, sowohl der ursprünglichen Anziehung, als Zurückstoβung, in verschiedenen Entfernungen der Materie und ihrer Teile von einander, welches, da es nun lediglich auf dem Unterschiede der Richtung dieser beiden Kräfte (da ein Punkt getrieben wird, sich entweder andern zu nähern, oder sich von ihnen zu entfernen) und auf der Gröβe des Raumes beruht, in den sich jede dieser Kräfte in verschiedenen Weiten verbreitet, eine reine mathematische Aufgabe ist, die nicht mehr für die Metaphysik gehört, selbst nicht was die Verantwortung betrifft, wenn ess etwa nicht gelingen sollte, den Begriff der Materie auf diese Art zu konstruieren. Denn sie verantwortet bloβ die Richtigkeit der unserer Vernunfterkenntnis vergönnten Elemente der Konstruktion, die Unzulänglichkeit und die Schranken unserer Vernunft in der Ausführung verantwortet sie nicht."

> we lack all means for *constructing* this concept of matter, and presenting what we thought universally as possible in intuition.[10]

Kant's failure to construct his dynamical concept of matter obviously raises worries about his special-metaphysical project, if not jeopardizes it entirely, and commentators have detailed the inescapable difficulties dogging this dynamical concept of matter[11] as well as its context of motivations.[12] Thus, it remains surprising that Kant

[10] MFNS 234; Ak.4: 525: "…wenn der Stoff selbst in Grundkräfte verwandelt wird (deren Gesetze a priori zu bestimmen, noch weniger aber eine Mannigfaltigkeit derselben, welche zu Erklärung der spezifischen Verschiedenheit der Materie zureichte, zuverlässig anzugeben, wir nicht im Stande sind), uns alle Mittel abgehen, diesen Begriff der Materie zu *konstruieren*, und, was wir allgemein dachten, in der Anschauung als möglich darzustellen."

[11] For an excellent and thorough presentation of these problems, see Westphal (1995), 395-404. Some finer points may be made about these problems in the light of Westphal's illuminating account, especially as concerns talk of problems *internal* to the dynamical concept of matter as an interplay of fundamental forces *and* in regard to the evasion or impossibility of an actual construction of this concept:

(1) The problems affecting this concept are said to involve a 'circle,' which gives the impression that the problems are intrinsic to the reasoning in the text itself. But I believe they are not easily classed as such and mainly rest on a set of extrinsic or at least indirect considerations. In gist, Kant's dynamical concept explains the determinate space-filling by matter in terms of a constitution from opposed fundamental forces of attraction and repulsion. The 'circularity' here is made manifest in the context of understanding the density of matter, which is important for Kant because his dynamical concept of matter opposes the mechanistic concept of matter precisely on this count by purporting to prove that the same spatial volume of matter may vary in density without appealing to the hypothesis of hard particles and voids. The 'circle' in question asserts the dependence of such a property of matter on attraction, while attraction itself depends on this space-filling property of matter. But the two 'attractions' are not the same – a resolution of the 'circle' would show that the first fundamental matter-constituting attraction is different from the second attraction dependent on considerations of density. The latter, to Kant's mind, approaches the Newtonian concept of gravitation; Kant *wants* to hold gravitation as a fundamental force, *which* then would identify the two 'attractions' and generate the 'circle,' whereas resolving the circle shows gravitation to be a derivative (not fundamental) force. It is clear that the circle really stems from extrinsic requirements of what Kant *would have liked* his concept of attraction to be like rather than a problem internal to the structure of his dynamical concept itself.

(2) The difficulty of constructing the dynamical concept really attaches to the assumption of a mathematical viewpoint, according to which, there are only two fundamental forces – attraction and repulsion – according to the only relations two moving points in space can have with respect to each other. (Cf. ibid., 405). Accordingly, *once* the mathematical viewpoint is dropped, there *can* be more than two fundamental forces. Further, internally coherent, explications of concepts of density and cohesion in the context of overcoming the 'circle' *would* compel one precisely to drop such a strict limit of there being only two fundamental forces, and by that same token, do away with the over-reliance on the mathematical viewpoint. Since the mathematical viewpoint is what is at issue in the construction of the dynamical concept of matter (and this is what Kant reminds us of in the first of the two passages quoted above) – it is again clear that the problem *here* is – not so much about the very impossibility of constructing a dynamical concept as – about the inconsistencies between a metaphysical account of the number and kinds of forces a successful dynamical concept *should* have and the said restriction to only two fundamental forces.

refrains from the requisite construction and satisfies himself with the enumeration of the "elements" of this construction alone. But what is even more surprising is that Hegel raises no questions in this regard. This would cast serious doubts on Hegel's competence as Kant's critic, but for his having signaled an awareness of this issue as well as indicated his own line of interest. I read Hegel as having taken care to distinguish the absence of the actual construction from the presentation of the elements of one such; in the earlier of the two passages from his Remark quoted above, he says, "Kant, as we know, *constructed* matter from the forces of attraction and repulsion, or at least he has, to use his own words, set up the metaphysical elements of this construction." His Remark, then, focuses on the latter "elements" themselves and his objections can be said to attend mainly to two areas of concern: (1) The alleged empiricity of the starting point of Kant's

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(3) The problem of internal inconsistency in constructing the dynamical concept emerges *properly* only in considering the possible constructions of the concept of density that results from Kant's views. Kant's treatment of the latter ends up going against his hopes to provide a theory that explains different degrees of filling space for the same given volume of matter. *Because* Kant appeals to what has been called a 'monadological interpretation of substance' (see following footnote), he can only construct the concept of matter he hopes for by means of a model where a given volume consists of different amounts of 'basic matters,' where the volume and its content consists of matter thought of as active centers of force with a sphere of repulsion. That is, because of the pressures of his monadological interpretation, a determinate volume of matter is thought of as a sphere whose radius is determined by the mutual limitations of attractive and repulsive forces that are taken as emanating from a central point. The account of density then runs into construction-problems that cannot 'fit' a number of such spheres inside a given one without generating interstitial voids or unexplained distortions (ibid., 400-401 & 423n.153). Again, the state of affairs is as follows: *were* Kant to construct his dynamical concept of matter, he would find that it conflicts with his stated goal of providing an account of density that trumps the mechanistic explanation through hard particles and voids, and the problem of construction proper in this *emerges from* his unexplained reliance on a certain monadological interpretation, which is thus a prior puzzle.

[12] Cf. Edwards (2000), ch.7, esp. 134-144, which situates Kant's present unwillingness to offer an actual construction of this concept (along with self-created obstacles to this construction in the form of a 'monadological interpretation of substance' that is just at odds with Kant's theory in this phase of his work) in the larger context of Kant's adherence to 1) certain Critical architectonic principles that seek to maintain a strong distinction between metaphysical and empirical modes of physical inquiry and 2) the concept of a physical aether that remains dominantly present through various phases of Kant's thought.

analyses and (2) the irreducible duality of fundamental forces. I will now evaluate these objections in turn.

(1) *The alleged empiricity of the starting point of Kant's analyses*: Hegel rightly thinks that since no construction has been offered and all that we have is the presentation of elements for one, Kant has not really proved the a priori possibility of the dynamical concept of matter and consequently the projected construction too just amounts to an analysis of concepts, not a synthesis in intuition. But Hegel wrongly thinks that this analysis is conducted upon concepts gained from experience, believing that Kant's appeal to a repulsive force of matter is merely an inference to the cause of an impenetrability *perceived through touch*. Further, this empirical reflection is incomplete because, while it draws the concept of repulsive force from perceived impenetrability, it seeks to ground the other fundamental force of attraction upon an inference from this same representation of matter as impenetrable rather than directly on empirical perception. That is, Kant holds that if matter were constituted solely from repulsive forces, it would disperse itself to infinity and ultimately cease to exist or at least to cohere with our ordinary sense perception of matter. Therefore, an opposed force of attraction must also be posited as a condition for such a matter in addition to the repulsive force. But, Hegel feels that even this second force of attraction could have been just as easily drawn immediately from the empirical representation of matter as having cohesion among its parts. In Hegel's words (translations modified):

Kant's method in the deduction of matter from these forces, which he calls a *construction*, when looked at more closely does not deserve this name, unless any exercise of reflection, even analytical reflection, is to be called a construction… For Kant's method is basically analytical, not constructive. He *presupposes the representation of matter* and then asks what forces are required to maintain the determinations he has presupposed.[13]

[H]e derives repulsion too, from matter and gives as the reason *that we represent matter as impenetrable*, since it presents itself under this determination to the *sense of touch* by which it manifests itself to us. Consequently, he proceeds, repulsion is at once thought in the *concept* of matter because it is immediately *given* therein, whereas attraction is added to the concept through *inference*.[14]

…Kant from the start one-sidedly attributes to the concept of matter only the determination of impenetrability, which we are supposed to *perceive* by the *sense of touch*, for which reason the force of repulsion, as the holding off of an other from itself is immediately *given*. But if, further, the *existence* of matter is supposed to be impossible without attraction, then this assertion is based on a representation of matter taken from perception; consequently, the determination of attraction too, must come within the range of perception. It is indeed easy to perceive that matter, besides its being-for-self, which sublates the being-for-other (offers resistance), has also a relation between its self-determined parts, a spatial extension and cohesion, and in rigidity and solidity the cohesion is very firm.[15]

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[13] Hegel (1969), 179-180; TWA 5: 201-202: "Kants Verfahren in der Deduktion der Materie aus diesen Kräften, das er eine Konstruktion nennt, verdient, näher betrachtet, diesen Namen nicht, wenn nicht anders jede Art von Reflexion, selbst die analysirende, eine Konstruktion genannt wird… Kants Verfahren ist nämlich im Grunde *analytisch*, nicht konstruirend. Er *setzt die Vorstellung der Materie voraus*, und fragt nun, welche Kräfte dazu gehören, um ihre vorausgesetzten Bestimmungen zu erhalten." Hegel continues this Kant-polemic in more general terms in the context of his own theory of analytic cognition later in the book; cf. ibid., 786-791; TWA 6: 501-508.

[14] Ibid., 180; TWA 5: 202: "Die Repulsion… leitet er gleichfalls aus der Materie ab, und giebt als Grund derselben an, *weil wir uns die Materie undurchdringlich vorstellen*, indem diese nämlich dem *Sinne des Gefühls*, durch den sie sich uns offenbare, sich unter dieser Bestimmung präsentiert. Die Repulsion werde daher ferner sogleich im *Begriffe* der Materie gedacht, weil sie damit unmittelbar *gegeben* sei; die Attraktion dagegen werde derselben durch *Schlüsse* beigefügt."

[15] Ibid., 180-181; TWA 5: 202-203: "…Kant zum Begriffe der Materie von vornherein einseitig nur die Bestimmung der *Undurchdringlichkeit* rechnet, die wir durch das *Gefühl wahrnehmen* sollen, weswegen die Repulsivkraft, als das Abhalten eines Anderen von sich, unmittelbar gegeben sei. Wenn aber ferner die Materie ohne Attraktivkraft nicht soll *dasein* können, so liegt für diese Behauptung eine aus der Wahrnehmung genommene Vorstellung der Materie zu Grunde; die Bestimmung der Attraktion muß also gleichfalls in der Wahrnehmung anzutreffen sein. Es ist auch wohl wahrzunehmen, daß die Materie außer ihrem Fürsichsein, welches das Sein-fur-Anderes aufhebt, (den Widerstand leistet), auch *eine Beziehung des Fürsichseienden aufeinander*, räumliche *Ausdehnung* und *Zusammenhalt*, und in Starrheit, Festigkeit einen sehr festen Zusammenhalt hat."

Squarely put, Hegel's objections are off the mark, although I will show below that they should be read into rather than just dismissed. He is wrong to hold that Kant develops the discussion of repulsion merely from empirical perceptions of impenetrability. Now, Kant does say that impenetrability is the fundamental property of matter "whereby it first manifests itself to our outer senses, as something real in space,"[16] and that attractive force "simply does not present itself so immediately to the senses as impenetrability… [and] because it is not felt, but it is only to be inferred, it has so far the appearance of a derived force."[17] But Kant's reason for according priority to repulsion is not that the senses directly announce it whereas attraction is merely inferred. Rather, Kant thinks that this priority stems from the different natures of what is indicated through these concepts: impenetrability indicates an actual object in space whereas attraction only indicates the direction of a 'pull.' In fact, Kant explains that we would still choose to accord primacy to impenetrability and repulsion in analyzing an object of outer sense (matter) because of this reason, *even if* our senses were somehow so enhanced to feel attraction:

> Why is the latter [impenetrability] immediately given with the concept of a matter, whereas the former is not thought in the concept, but only adjoined to it through inferences? That our senses do not allow us to perceive this attraction so immediately as the repulsion and resistance of impenetrability cannot yet

[16] MFNS 220; Ak.4: 508: "Die Undurchdringlichkeit, als die Grundeigenschaft der Materie, wodurch sie sich als etwas Reales im Raume unseren äußeren Sinne zuerst offenbart…"

[17] MFNS 224; Ak.4: 513: "Sie [Anziehungskraft] bietet sich nur nicht so unmittelbar den Sinnen dar, als die Undurchdringlichkeit, uns Begriffe von bestimmten Objekten im Raume zu liefern. Weil sie also nicht gefühlt, sondern nur geschlossen werden will, so hat sie so fern den Anschein einer abgeleiteten Kraft, gleich als ob sie nur ein verstecktes Spiel der bewegenden Kräfte durch Zurückstoßung wäre."

> provide a sufficient answer to the difficulty. For even if we had such a capacity, it is still easy to see that our understanding would nonetheless choose the filling of space in order to designate substance in space, that is, matter… Attraction, even if we sensed it equally well, would still never disclose to us a matter of determinate volume and figure, but only the striving of our organ to approach a point outside us (the center of the attracting body)… [W]e thereby obtain no determinate concept of any object in space… (The mere direction of attraction would be perceivable, as in the case of weight: the attracting point would be unknown, and I do not even see how it could be ascertained through inferences, without perception of matter insofar as it fills space).[18]

Thus, Kant easily counters Hegel's charge that he has merely assumed empirical-sensual determinations in order to set up repulsive force as a fundamental constituent of his dynamical concept of matter. Similarly, there is no need to assume another empirical property such as cohesion to infer attractive force as its cause, but rather the inference of such a force as a second necessary condition of matter as a spatially bounded entity is explained as well. Much can be said about Hegel's singling out of the concept of cohesion, which, as we saw (see my f.n.11 above), should feature in Kant's reworking of his dynamical concept of matter, if it is to successfully produce an account of varying densities of bodies and renounce its insistence on a mathematically inspired exposition of fundamental forces; but we can leave that aside for now. Yet, it is interesting to see in

[18] MFNS 220-221; Ak.4: 509-510: "[W]arum wird die letztere [die Undurchdringlichkeit] unmittelbar mit dem Begriffe einer Materie gegeben, die erstere [Anziehungskraft] aber nicht in dem Begriffe gedacht, sondern nur durch Schlüsse ihm beigefügt? Daβ unsere Sinne uns diese Anziehung nicht so unmittelbar wahrnehmen lassen, als die Zurückstoβung und das Widerstreben der Undurchdringlichkeit, kann die Schwierigkeit noch nicht hinlänglich beantworten. Denn, wenn wir auch ein solches Vermögen hätten, so ist doch leicht einzusehen, daβ unser Verstand sich nichts destoweniger die Erfüllung des Raumes wählen würde, um dadurch die Substanz im Raume, d.i. die Materie zu bezeichnen… Anziehung, wenn wir sie auch noch so gut empfänden, würde uns doch niemals eine Materie von bestimmten *Volumen* und *Gestalt* offenbaren, sonder nichts als die Bestrebung unseres Organs, sich einem Punkte auβer uns (dem Mittelpunkt des anziehenden Körpers) zu nähern… Nun bekommen wir dadurch keinen bestimmten Begriff von irgend einem Objekte im Raume… (die bloβe Direktion der Anziehung würde wahrgenommen werden können, wie bei der Schwere: der anziehende Punktwürde unbekannt sein, und ich sehe nicht einmal wohl ein, wie er selbst durch Schlüsse, ohne Wahrnehmung der Materie, so fern sie den Raum erfüllt, sollte ausgemittelt werden)." Cf. Edwards (2000), 132-133.

the immediate context *why* Hegel recalls the concept of cohesion, even aside from the challenges this concept poses to Kant's own program.

Hegel's intention, I believe, is to call two things to our attention: first, that Kant's two fundamental forces can both be seen as *immediate* givens if we persist with the empirical standpoint allegedly adopted by Kant, and second, that Kant's prioritization, on the other hand, of the givenness of repulsion *and* appending of attraction as an inference thereto, undercuts this immediate givenness and amounts to a rudimentary, an almost unwittingly upheld *mediation* of the two forces with each other. This point will be developed in the course of considering Hegel's second objection about the irreducible duality of forces. But it helps already to see how Hegel is setting up that objection and that he does so in the context of thinking matter's spatiality, not just its mere existence.[19] For we saw above that Hegel thinks that just as repulsion is made immediately evident from impenetrability, so can attraction from cohesion; and just as the former is an empirical perception presupposing the *existence* of matter, so would the latter have to be shown in direct connection with such existence. Yet, Kant chose not to pursue this line

[19] The significance of this thematic of spatiality and existence, unclear at the moment, will be unfolded over the next several pages as we begin to understand it in terms of Hegel's rethinking of the methodology of Kantian construction. In the following, I am using these terms, especially *existence*, in a non-technical sense. This could be confusing because the reader may also have in the back of her mind the specific Hegelian context of this discussion, namely, Hegel's account of the dialectic of being (*Sein*) in his *Science of Logic*. Hegel deploys several concepts indicating various modes of being in the course of this dialectical examination, such as 'determinate existence' (*Dasein*), 'being-for-other' (*Sein-für-Anderes*), 'otherness' (*Anderssein*), 'being-in-itself' (*Ansichsein*) 'being-within-self' (*Insichsein*), 'being-for-one' (*Sein-für-Eines*), 'being-for-self' (*Fürsichsein*), etc. Further, 'existence' (*Existenz*) too is a Hegelian technical term. Thus, to avoid terminological confusion, I will mention the German term parenthetically when I am recalling Hegel's technical terms as I have done here; if there is no such parenthetical appendage, the term in question is used in an ordinary sense. That Hegel is using these terms in a strictly technical sense is clear from his comments on the various forms of immediacy at Hegel (1969), 708-709; TWA 6: 406-407.

of reasoning and forsook appeals to cohesion. Hegel tries to follow Kant's thought in lines immediately following those quoted earlier about the reference to cohesion:

> In point of fact, if we consider Kant's arguments from which the force of attraction is supposed to be deduced [as a second force limiting the action of repulsion]… it is apparent that their sole content is this, that through repulsion alone matter would not be *spatial*. Matter being presupposed as filling space, it is credited with continuity, the ground of which is assumed to be the force of attraction.[20]

Here, Hegel puts his finger on the fact that Kant's analysis of attractive force restricts itself to precisely the topic of the spatiality of matter *aside* from its existence, since the former is what is crucial to the prioritization of repulsion whereas the latter could have been equally well thematized through a reference to cohesion as an immediately perceived empirical property. Hegel is pointing to an inner mediation within the concept of repulsion itself such that the concept of attraction is somehow 'contained' in the concept of repulsion; and this mediation is brought into view by focusing on matter's spatiality. Still, this remains a one-sided reflection that does not pursue a similar inner mediation within the concept of attraction itself to show how repulsion issues from it in a parallel manner. Perhaps, this could have been done by analyzing the concept of cohesion and unpacking the immediacy of this determination, but this was not done. Kant's insistence on the irreducible duality of fundamental forces,

[20] Hegel (1969), 181; TWA 5: 203: "In der That, wenn die kantischen Schlüsse, aus denen die Attraktivkraft abgeleitet werden soll, betrachtet werden… so enthalten sie nichts, als daß durch die bloße Repulsion die Materie nicht räumlich sein würde. Indem die Materie, als Raum erfüllend vorausgesetzt ist, ist ihr die Kontinuität zugeschrieben, als deren Grund die Anziehungskraft angenommen wird." We ignore for now Hegel's reference to the continuity of matter as a consequence of attraction, since this is tied up with the topic of the next objection.

which was noted earlier to depend upon a purely mathematical description, is thus interpreted as a one-sided reflection. This brings us to the second of Hegel's objections.

(2) *The irreducible duality of fundamental forces*: Hegel lauds Kant for launching a critique of the "vulgar mechanistic mode of representation which stops short at the one determination of impenetrability."[21] On the mechanistic view, if matter is conceived as standing in relation to others or as consisting of relations among its parts, these relations can only be thought of as external ones in the form of external pressures and thrusts transmitting motion to matter. When Kant tries to think of matter itself as constituted from a play of fundamental forces, he overcomes this externality of relation in matter, especially insofar as attraction itself signifies such an overcoming.

In his *Philosophy of Nature*, Hegel will show how the 'correct' account of matter includes the immanence of motion to matter that does away with the absolute externality of material relations. Here, however, he is concerned with the fact that Kant's move towards such a position remains incomplete. The fact that the two forces themselves are fundamentally fixed in their opposition to each other, and not properly the functions of a mediation between themselves, prevents Kant from a complete critique of the mechanistic standpoint: "It is true that Kant sublates this externality insofar as he makes attraction (the relation of matters to one another insofar as these are assumed as separated from one another, or matter generally in its self-externality) a *force of matter itself*; still,

[21] Hegel (1969), 181; TWA 5: 203-204. See the passage quoted above at f.n.6.

on the other hand, his two fundamental forces within matter remain externally and independently [fixed] *against each other*." (Trans. modified)[22]

Hegel's complaint is that while Kant does show that repulsion and attraction are both required for the unity of matter, attraction and repulsion themselves remain fixed in their opposition to each other; they do have a unity in matter but not through themselves. His own dialectical investigation of the categories of being (*Sein*; the dialectic of the One and the Many is particularly relevant here), shows that attraction and repulsion each presupposes and mutually posits the other. Of course, the dialectical investigation of being does not treat of attraction and repulsion qua forces of sensible matter, but, for Hegel, they "are also based on the pure determinations here considered of the one and the many and their inter-relationships, which, because these names are most obvious, I have called repulsion and attraction."[23]

Hegel's criticism is also directed at attraction and repulsion as forces of matter, which are *distinguished* as "penetrative" and "surface" forces respectively. In essence and as a whole, his charges are leveled against Kant's "monadological interpretation of substance" (cf. f.n.11, 12 above) in connection with the continuity of matter that seems to

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[22] Ibid., 181; TWA 5: 204: "Indem Kant jene Äußerlichkeit zwar insofern aufhebt, als er die Attraktion, die *Beziehung der Materien aufeinander, insofern diese als voneinander getrennt angenommen werden, oder der Materie überhaupt in ihrem Außersichsein, zu einer Kraft der Materie selbst* macht, so bleiben jedoch auf der anderen Seite seine beiden Grundkräfte, innerhalb der Materie, äußerliche und für sich selbstständige *gegeneinander*."

[23] Ibid., 179; TWA 5: 201: "Eine solche Existenz, wie die sinnliche Materie, ist zwar nicht ein Gegenstand der Logik, eben so wenig als der Raum und Raumbestimmungen. Aber auch der Attraktiv- und Repulsiv-Kraft, sofern sie als Kräfte der sinnlichen Materie angesehen werden, liegen die hier betrachteten reinen Bestimmungen vom Eins und Vielen, und deren Beziehungen aufeinander, die ich Repulsion und Attraktion, weil diese Namen am nächsten liegen, genannt habe, zu Grunde." For the details of the dialectic of the One and the Many as forms of existence and in the relations of attraction and repulsion, cf. ibid., 156-178; TWA 5: 174-200.

be at odds with it; in point of fact, the charges refer to Kant's description of repulsion as a surface force in the following passage that Hegel quotes almost verbatim from the *Metaphysical Foundations*: "The parts in *contact* each limit the sphere of action of the other, and the force of repulsion cannot move any more distant part except by means of the intervening parts; an immediate action of one part of matter on another passing right across these intervening parts by forces of expansion (which means here, forces of repulsion) is impossible." (Trans. slightly modified)[24]

We have seen how repulsion is accorded a primacy in Kant's dynamical concept of matter, since the property of filling a space is thought only through repulsion; attraction is added inferentially to the latter as a condition of maintaining this property coherently, i.e., as a condition of filling space *determinately*. Kant goes on to qualify the repulsive force as a *surface* force acting through immediate contact. He defines physical contact as a function of impenetrability, which involves the dynamical relation of repulsive forces in addition to the concept of determinate spatial boundaries.[25] Attraction is said to be a *penetrative* force that acts independently of the condition of contact, because it "contains the very ground of the possibility of *matter as that thing which fills a*

[24] Ibid., 182; TWA 5: 205: "Die einander *berührenden* Teile begrenzen einer den Wirkungsraum des andern, und die repulsive Kraft könne keinen entferntern Teil bewegen ohne vermittelst der dazwischenliegenden, und eine quer durch diese gehende unmittelbare Wirkung einer Materie auf eine andere durch Ausdehnungskräfte (das heißt hier Repulsivkräfte) sei unmöglich." This corresponds to the first few sentences of Erklärung 7: Zusatz, Ch. 2 of the *Metaphysical Foundations* (MFNS 227; Ak.4: 512).

[25] Cf. MNFS 223; Ak.4:511-512: "Berührung im physischen Verstande ist die unmittelbare Wirkung und Gegenwirkung *der Undurchdringlichkeit*… Die Berührung in mathematischer Bedeutung ist die gemeinschaftliche Grenze zweier Räume… Die mathematische Berührung wird bei der physischen zum Grunde gelegt, aber sie macht sie allein noch nicht aus, zu ihr muβ, damit die letztere daraus entspringe, noch ein dynamisches Verhältnis und zwar nicht durch Anziehungskräfte, sondern der zurückstoβenden, d.i. der Undurchdringlichkeit hinzugedacht werden. Physische Berührung ist Wechselwirkung der repulsiven Kräfte in der gemeinschaftlichen Grenze zweier Materien."

space to a determinate degree, and so contains even [the ground] of the possibility of physical contact thereof. It must therefore precede the latter, and its action must thus be independent of the condition of contact."[26] Attractive force is thus an *actio in distans*, passing immediately through empty space, while repulsion as a moving force depends on contact and acts through the mediation of filled space.

Hegel raises a number of charges against this way of distinguishing attractive and repulsive forces: (A1) the action of attractive force, he tells us, is just as mediated as the action of repulsive forces and hence the distinction between the latter as an action mediated through intervening matter and the former as an *actio in distans* exempt from such mediation is illegitimate; (A2) if attraction was truly a penetrative force fundamental to all parts of matter, then its action would be of necessity mediated and not immediate, because the attraction between any two parts would necessarily include a reference to the attraction inherent in other parts of matter that relate to the given ones; (R1) the description of repulsive force as acting through contact presupposes matter as completed and constituted and not as the result of its action, which means that the force of repulsion is already immanently sublated in its action; (R2) repulsive force too is penetrative like attractive force and acts beyond the region of contact, because matters between which this force is present remain separated as a whole and not just at a given surface. In Hegel's words (with my numbering added in accordance with the above):

[26] My italics. Cf. MFNS 223; Ak.4:512: "Die ursprüngliche Anziehungskraft enthält den Grund der Möglichkeit der Materie, als desjenigen Dinges, was einen Raum in bestimmten Grad erfüllt, mithin selbst sogar von der Möglichkeit einer physischen Berührung derselben. Sie muβ also vor dieser vorhergehen, und ihre Wirkung muβ folglich von der Bedingung der Berührung unabhängig sein."

[A1]…in assuming *nearer* or *more distant* parts of matter, the same *distinction* would likewise arise *with respect to attraction*, namely, that though one atom acted on another, yet a third, more distant atom (between which and the first atom, the second atom would be), would first enter into the sphere of attraction of the intervening atom nearer to it; therefore the first atom would not have an *immediate*, simple action on the third, from which it would follow that the action of the force of attraction, like that of repulsion, is equally mediated. [A2] Further, the *genuine penetration* of the force of attraction could of necessity consist only in this, that every part of matter was *in and for itself* attractive, not that a certain number of atoms behaved passively and only one atom actively. [R1] But we must at once remark with respect to the force of repulsion itself that in the passage quoted, *parts in contact* are mentioned which implies *solidity* and *continuity* of a matter already finished and complete which would not permit the passage through it of a repelling force. But this solidity of matter in which parts are in *contact* and are no longer separated by the void already presupposes *that the force of repulsion is sublated*; according to the sensuous conception of repulsion which prevails here, parts in contact are to be taken as those which do not repel each other. It therefore follows, quite tautologically, that where repulsion is assumed to be not, there no repulsion can take place. But from this nothing else follows which could serve to determine the force of repulsion. [R2] However, reflection on the statement that parts in contact are in contact only in so far as they hold themselves *apart*, leads directly to the conclusion that the force of repulsion is not merely *on the surface* of matter but within the sphere which was supposed to be only a sphere of attraction.[27]

[27] Hegel (1969), 182-183; TWA 5: 205-206: "…indem *nähere* oder *entferntere* Teile der Materie angenommen werden, *in Rücksicht auf die Attraktion* gleichfalls *der Unterschied* entstünde, daß ein Atom zwar auf ein *anderes* einwirkte, aber ein *drittes* Entfernteres, zwischen welchem und dem ersten Attrahirenden das *andere* sich befände, zunächst in die Anziehungssphäre des dazwischenliegenden ihm nähern träte, das Erste also nicht eine *unmittelbare* einfache Wirkung auf das Dritte ausüben würde; woraus sich eben so ein vermitteltes Wirken für die Attractivkraft als für die Repulsivkraft ergehe; ferner müßte das *wahre Durchdringen* der Attraktivkraft allein darin bestehen, daß alle Teile der Materie *an und für sich* attrahirend wären, nicht aber eine gewisse Menge passiv und nur Ein Atom aktiv sich verhielte. -- Unmittelbar oder in Rücksicht auf die Repulsivkraft selbst aber ist zu bemerken, daß in der angeführten Stelle sich *berührende* Teile, also eine *Gediegenheit* und *Kontinuität* einer *fertigen* Materie vorkommt, welche durch sich hindurch ein Repelliren nicht gestatte. Diese Gediegenheit der Materie aber, in welcher Teile sich *berühren*, nicht mehr durch das Leere getrennt sind, setzt das *Aufgehobenseyn der Repulsivkraft* bereits voraus; sich berührende Teile sind nach der hier herrschenden sinnlichen Vorstellung der Repulsion als solche zu nehmen, die sich nicht repelliren. Es folgt also ganz tautologisch, daß da, wo das Nichtsein der Repulsion angenommen ist, keine Repulsion stattfinden kann. Daraus aber folgt nichts weiter für eine Bestimmung der Repulsivkraft.--Wird aber darauf reflektirt, daß berührende Teile sich nur insofern berühren, als sie sich noch *außereinander* halten, so ist eben damit die Repulsivkraft nicht bloß auf der Oberfläche der Materie, sondern innerhalb der Sphäre, welche nur Sphäre der Attraktion sein sollte." Hegel's references are to the passage quoted in my footnote 24 above.

The specifics of Hegel's criticisms are open to debate. One may defend the letter of Kant's theory against them, e.g., by pointing out against (A1) that Kant has indeed offered proofs (Ch.2, Lehrsätze 7, 8) showing how attractive force is an immediate action through empty space up to infinity and is not mediated by any intervening matter; or against (A2) that Kant indeed accommodates talk of the "uniting of this attraction [of an individual bit of matter] with that of all matter in the universe"[28]; or against (R1) that Kant has dealt with concepts such as continuity and solidity so far as they pertain to matters "finished and completed" as *derivative* concepts, which are not originally constitutive of matter, in his "General Remark to Dynamics"[29]; or against (R2) that Hegel's portrayal of bits of matter held apart through opposed repulsive forces ignores Kant's account of possibly infinite compression and thoroughly relative impenetrability of matter thought purely through repulsion.[30] On the other hand, one may celebrate the farsighted acuity of Hegel's criticisms that, e.g., underscore the problems in upholding gravitation in the form of universal attraction as an original force of matter while relegating cohesion to a derivative force, or which expose the sophistical fabrications of different sorts and levels of continuity and separation within matter.

I am sure that Hegel's criticism is a bit of both. I think, however, that there is a more important dimension to his reading, which, as we saw in considering his first set of

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[28] Cf. Zusatz 2 to Lehrsatz 8 (MFNS 228-229; Ak. 4:518) and MFNS 233; Ak.4: 523-524. MFNS 228; Ak.4:518: "[E]s mag nun sein, daß der erstere [einen bestimmten Grad der Erfüllung des Raums] von der eigenen Anziehung der Theile der zusammengedrückten Materie unter einander, oder von der Vereinigung derselben mit der Anziehung aller Weltmaterie herrühre."

[29] MFNS 233-244; AK.4: 523-535.

[30] Cf. Lehrsatz 3, its proof and Kant's Anmerkung (MFNS 213; Ak.4: 501).

objections, unravels an underlying narrative of spatiality and existence in regard to matter. For this, notice that the thrust of Hegel's critique stems from (R1), which challenges Kant's assumption that repulsive forces act only through contact. For Kant had shown only that contact is a function of repulsive forces, *not* that repulsion can be understood through contact alone. Kant was aware of this problem in his theory and sought to extricate himself by instituting a distinction between the actual spaces of material constitution (continuous) and those presumed to facilitate geometrical representation and construction (discrete).[31] Nevertheless, this remains an ad hoc assumption about the way repulsive forces operate and Hegel is right to focus on this in order to undermine the rest, e.g., viewing attraction *as independent of the condition of contact*, which follows upon this. We can magnify this point to see it better.

Repulsive forces that belong inherently to matter as original moving forces can interact among matters; this action of repulsion is called 'compression,' and the property of matter in this respect, 'elasticity.' Physical contact was defined as this interaction of repulsive forces *plus* the mathematical notion of a shared boundary for determinate spaces. Since attraction is the ground of the possibility of matter as *filling space determinately* (and, in this sense, a condition of matter properly speaking), it is said to be independent of the condition of contact. That is, attraction precedes the interaction of repelling materials simply because each of these interacting bits requires attraction already in order to be such. But now, this simply means that the mere interaction of materials through repulsive forces alone is also not enough to generate contact, since the latter involves the concept of a determinate space *in addition* to the dynamical interaction

[31] Cf. Anmerkung 2 to Lehrsatz 8 (MFNS 231-233; Ak. 4: 521-523).

of repulsive forces. Thus, it is incorrect to say that the operation of repulsion by itself consists in contact or that it is essentially a surface force, because without the input of attraction there is as yet no concept of surface. This is why Kant thinks that the spatial representation of contact and the interaction of repulsive forces is a construction-requirement and not a property of matter itself; and this is also why Hegel's (R1) objects that Kant has assumed the completed spatial formation of matter in asserting the purely surface action of repulsion. According to Hegel, this has two further implications:

1. The action of repulsion as an originally constitutive force of matter is not bounded by the condition of contact any more than the action of attractive force. And the action of repulsion in a constituted piece of matter, which is conditioned by contact, also includes the thought of a sublation of repulsion, since the result of unhindered repulsion would be the void, whereas the talk of 'contact' means that the void has been warded off and repulsion in some sense negated. If the original negation of repulsion is attraction, this just means that the concept of action through contact or surface action is as much the mode of operation of attraction as of repulsion. Kant too seems to recognize this, as he reflects on actions of repulsion in impact and pressure that draw matter closer even contrary to the effect of essential repulsive forces. In contact, we have mere impenetrability at play, which is the cessation of motion; yet to think the approach of matters even through impact and pressure at this point means to include a reference to attraction, otherwise such approach "would have no cause, or at least none lying originally in the nature of matter."[32]

[32] Cf. Anmerkung 2 to Lehrsatz 7 (MFNS 225; Ak.4: 514: "denn sonst könnten selbst die drückenden und stoβenden Kräfte, welche die Bestrebung zur Annäherung hervorbringen sollen, da sie in entgegengesetzter Richtung mit der repulsiven Kraft der Materie wirken, keine, wenigstens nicht in der Nature der Materie ursprüngliche liegende, Ursache haben."). Of course, Kant is here also reflecting on the

2. The reference to contact seems to put us in the field of already constituted matters with their motions, which, in Kant's scheme, properly belongs to the mechanical explication of matter. According to this scheme, the mechanical explication presupposes the dynamical explication since the communication of motions through moving forces (mechanics – which treats of matter *in* motion) is supposed to rest on the prior explication of a causally active presence in space at all (dynamics – which can also treat of matter at rest).[33] But the talk of contact, the approach of matters under and outside the condition of contact, the impossibility of motion in contact, etc., seems to apply mechanical considerations within the dynamical sphere itself. This would conflict with the order of priority between the dynamical and mechanical explications of matter.

Kenneth Westphal has shown that a vicious circle infects Kant's discourse at this point, especially if we recall the first dynamical proposition that deduced repulsive force as a fundamental force of matter from the imagined case of another matter trying to penetrate a given one. The effected change in its approach (stopping or rebounding) led

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mode of action of attraction *outside* the condition of contact, but his reflections on the necessity of attraction to even account for the modes of action through repulsion resonate with Hegel's analysis: "denn eigentlich übt der Körper, dem ein anderer sich bloβ darum zu nähern bestrebt ist, weil dieser anderweitig durch Stoβ zu ihm getrieben worden, gar keine Anziehungskraft auf diesen aus. Aber selbst diese scheinbare Anziehungen [the approach of matter due to repulsive actions of impact and pressure] müssen doch zuletzt eine wahre [attraction proper as a fundamental force of matter] zum Grunde haben, weil Materie, deren Druck oder Stoβ statt Anziehung dienen soll, ohne anziehende Kräfte nicht einmal Materie sein würde (Lehrsatz 5)." (ibid.)

[33] Cf. MFNS 245; Ak.4: 536-537: "Der bloβ dynamische Begriff konnte die Materie auch als in Ruhe betrachten; die bewegende Kraft, die da in Erwägung gezogen wurde, betraf bloβ die Erfüllung eines gewissen Raumes, ohne daβ die Materie, die ihn erfüllte, selbst bewegt angesehen werden durfte. Die Zurückstoβung war daher eine ursprünglich-bewegende Kraft, um Bewegung zu *erteilen*; dagegen wird in der Mechanik die Kraft einer in Bewegung gesetzten Materie betrachtet, um diese Bewegung einer anderen *mitzuteilen*. Es ist aber klar, daβ das Bewegliche *durch seine Bewegung* keine bewegende Kraft haben würde, wenn es nicht ursprünglich-bewegende Kräfte besäβe, dadurch es vor aller eigener Bewegung in jedem Orte, da es sich befindet, wirksam ist…Also setzen alle mechanische Gesetze die dynamische voraus…"

to repulsion as a cause, as a fundamental moving force of something that fills space and resists penetration. Westphal points out that according to the phoronomy the motion or rest of a matter depends merely on our choice of reference frames, so the first dynamical proposition cannot talk of moving forces involved in the *communication* of motion in this scenario without invoking the mechanical principles fitted out for this purpose; on the other hand, the latter principles are supposed to rest on the dynamical ones for their own validity, and hence a circularity ensues.[34] The crux of this criticism – that the dynamics seems to transcend its self-imposed limitations in operating with the concept of causal relations of matters in motion – is already apprehended by Hegel:

> [W]hereas matter is supposed to be derived from its elements, it is presented throughout the entire discourse as already formed and constituted. In the definition of surface and penetrative force both are assumed as moving forces by means of which *matters* are supposed to be able to act in one or other of these ways. Here, therefore, they are represented as forces, not through which matter first comes into being but through which matter, as an already finished product, is only set in motion. But in so far as we are speaking of the forces through which different bodies act on one another and are set in motion, this is something quite different from the determination and relation which these forces were supposed to have as moments of matter. (Trans. slightly modified)[35]

Hegel's arguments (A1,2 & R1,2) rest on exploring this lack of fit between the constituting and constituted forces of matter and show, at bottom, that the action of

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[34] Cf. Westphal (1998), 405-406.

[35] Hegel (1969), 183-184; TWA 5: 207: "[I]n dem ganzen Vortrage, die Materie, die erst aus ihren Elementen hergeleitet werden soll, bereits als fertig und konstituirt vorkommt. In der Definition der Flächen- und der durchdringenden Kraft werden beide als bewegende Kräfte angenommen, dadurch *Materien* auf die eine oder die andere Weise sollen wirken können.--Sie sind also hier als Kräfte dargestellt, nicht durch welche die Materie erst zu Stande käme, sondern wodurch sie, schon fertig, nur bewegt würde. Insofern aber von Kräften die Rede ist, wodurch verschiedene Materien auf einander einwirken und sich bewegen, so ist dies etwas ganz anderes, als die Bestimmung und Beziehung, die sie als die Momente der Materie haben sollten."

attraction is identical with that of repulsion and vice-versa. As a result, the two forces sublate themselves and posit their inner unity across each other, rather than maintain themselves as irreducibly distinct. In this sense, these forces as "moments of matter" reflect the dialectic of the form of existence Hegel calls being-for-self (*Fürsichsein*). We noted earlier, and this is reinforced here, that Hegel wants to show that Kant's privileging of repulsion, and the (flawed) distinction of the actions of fundamental forces as surface or penetrative effects, is geared towards an account of the *spatiality* of matter. Hegel's criticism of this account, however, proceeds from the perspective of the determinations of *existence* as such that would apply to matter. Not only does this purport to prove that Kant's account of the spatiality of matter is deficient – (and *this* result of the passage we have been dissecting is made vivid by the condemnations that follow upon it, where Hegel stresses the vacuity of Kant's distinction between 'empty' and 'filled' spaces as correlated with the spheres of action of attractive and repulsive forces respectively[36]) – but also seeks to show that a separation of this account from grounding questions of existence underwrites Kant's efforts.

What is to be understood by the stress on the spatiality/existence distinction in Hegel's criticisms? I believe that Hegel wants to show that the logic of being underwrites the spatial analysis of matter in a different way than as on Kant's conception.

[36] Cf. ibid., 183; TWA 5: 206. Here, Hegel attacks Kant's concept of attraction whereby matter is supposed to *occupy* space without *filling* it because, on the one hand, it is independent of the force of repulsion that is responsible for filling space, and on the other, it acts at a distance without the mediation of intervening matter and thus through empty space. (Cf. esp. Zusatz to Erklärung 7, MFNS 227; Ak.4:516). On the basis of having shown that there is a dialectical mediation and not a fixed opposition between attractive and repulsive forces, Hegel claims that fixing a corresponding distinction between occupied and filled spaces is just as vacuous. Again, one may defend the letter of Kant's theory by recalling his explanation of this distinction (cf. my f.n.7 above), but one should not lose sight of the larger trajectory of Hegel's criticism along the lines of a spatiality/existence distinction, as I have been stressing.

Hegel has shown that Kant's theory is tarred with problems that arise from not apprehending the relation of spatiality and existence properly. While his evaluations focused narrowly on Kant's dynamical explication of matter, the objection can be extrapolated. We already saw that the phoronomy faced confounding problems in the effort to think the *space of motion* as negotiating both the empirical perception of motion as well as the geometrical representation of motion as a quantum. While the phoronomy treated matter as a *point*, the dynamics wants to think a *determinate space* for matter, and this requires the explication of the interplay of opposed forces whereby matter can be said to properly *exist*. The construction-procedure itself stands at the heart of this spatiality/existence dynamic, since it purports to address determinately *existent* natural things through *geometrical* proofs of their possibility. Clearly, these problems revolve around the concepts of spatiality and existence and we should attempt to articulate their reformulation at Hegel's hands.

As I said at the start of my analysis, Hegel is sensitive to the distinction between the givenness of matter as the object of an empirical concept and its general determinations that can be specified with reference to the categories (see f.n.5 and main text above). In a sense, Kant's method requires construction as a mediation between the given empirical and the pure categoreal determinations and thus maintains a strong methodological role for an account of spatiality. Hegel's doubts about the power of the constructive method are directed at such an account of spatiality as a construction-tool, which he considers unfit for the task. For him, the distance between empirical givenness and pure categoreal determination cannot be bridged through any 'imaginative' toying with spatial determinations. Rather, it rests on working through the logical structures of

thought itself, and at the same time, it needs to be seen how spatial determination is grounded in logical structures. Though the latter needs further comment, it is already apparent from the foregoing that this is why Hegel (in his second set of objections above) unpacks the inner dialectic of the opposed fundamental forces on the basis of his account of being-for-self (*Fürsichsein*). And this is also why Hegel (in his first set of objections above) took issue with Kant's prioritization of repulsive forces, which was oriented to an analysis of spatiality at the cost of an analysis of existence.

Thus, Hegel's criticisms of Kant's dynamical theory of matter bear wider implications beyond their immediate targets in that theory and envision a reformulation of Kant's metaphysical method of ascertaining the a priori concept of matter through construction. Even though Hegel seems to ignore the fine points of what Kant means by "construction," his criticism and reformulation may well be read as outlining an alternative "presentation of the a priori concept" of matter per its existence.[37] Painting

[37] I say that Hegel might have ignored the fine points of Kant's "construction" as he does not adhere to the strict Kantian sense of the term as a presentation of a concept in intuition a priori. Rather, Hegel wields the term in a much looser way beyond the strict Kantian definition of the term. But, this is not because he does not understand that definition, but because he is contemptuous of its philosophical contributions and proposes to replace it with his own view. The complexity of his position can be broached by separating out three different attitudes he preserves in regard to "construction":

(1) Hegel has a pretty good idea of the strict geometrical usage of "construction," which he explicates in his *Science of Logic* (Hegel [1969], 811-812; TWA 6: 533-535). In fact, if we carefully consider his view of congruence and what it entails (essentially asserting the *identity* of a single object across its part-determinations rather than between various objects), we would see that his view of construction even avoids a problem we saw on Kant's view (Cf. ibid., 809-811; TWA 6: 531-532). Kant's use of construction signaled the role of congruence, which in turn brought into play a plurality of given quantities amongst which identities were sought to be established. This contained problems about both the givenness of the quantities from the point of view of method as well as the obscurity over the idea of establishing identity through a mental motion of sorts through transposition of these quantities. Hegel's view of congruence avoids these problems, and accordingly, his view of construction would help Kant's own theory overcome its problems.

(2) So far as Kant's method of issuing metaphysical pronouncements with the aid of construction is concerned, Hegel is not interested in the details of the construction-procedures themselves, but rather he is concerned with the larger point of emulating a mathematical method in a philosophical sphere and how that is a doomed venture upon his terms. His particular complaint against Kant's *Metaphysical Foundations* in this context is that such emulation mixes up two methods, which Kant himself has done much to warn us against. The methods in question are analytic and synthetic methods of inquiry and Hegel

with a very broad brush, we may think of Hegel's account of matter in the *Philosophy of Nature* as doing just that, inasmuch as the logical categories are in some sense "presented" here in respect of their determinate existence, and on the ground of expressing this existence as fundamentally determined in spatial terms. By means of his reformulation, then, Hegel rethinks the central claim of the Kantian concept of construction – to provide evidence for the a priori possibility of a determinate natural type like matter by presenting its concept in pure intuition – by examining the relations between spatial determinations and categories of existence.

Hegel broaches this relation from various sides, which we can briefly list with a view to their parallel points of interest in Kant's theory: (1) The presentation of logical determinations *as existing* takes place on the terrain of *spatiality* as such, so that a priori knowledge of matter and the foundations of a rational physics rests on apprehending this aspect; this roughly mirrors the Kantian methodology of construction. (2) The explication of matter rests on unraveling and *realizing* the concept of *spatiality* in general and developing an account of formal motion from this such that (both this and dynamical)

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thinks that subjects such as physics are handled best by the former method of *reflection* while the geometrical constructive procedures of *demonstration* belong to the latter. Trying to apply the synthetic method to empirical physics does not fare well (cf. ibid., 814-815; 537-538). In Hegel's eyes, by showing how the content of a metaphysics conducted per the synthetic method leads to antinomies (ibid., 815-816; 539-540), Kant himself had demolished the credibility of such metaphysics and its method. Yet, he himself did not escape the same error of mixing methods, since he emulated the mathematical method in respect of what fundamentally, as we saw above, remained an inference to presupposed determinations (original forces) for and by reflection upon a given empirical object (matter): "In seinen *Anfangsgründen der Naturwissenschaft* hat er [Kant] selbst ein Beispiel gegeben, eine Wissenschaft, welche er auf dies Weise [d.i., durch die synthetische Methode] der Philosophie zu vindizieren gedachte, als eine Reflexionswissenschaft und in der Methode derselben zu behandeln." (ibid., 816; 539).

(3) I do believe that Hegel's own metaphysical theses on concrete objects of nature and spirit follows a trajectory which, in broad contours, tends towards a presentation of conceptual determiations upon the ground of pure spatial determinations, albeit in a radically modified form. In this sense, his own philosophical method is a massively refurbished 'construction' and this inspires his derision for the similar but deficient Kantian version of the concept. This will be made clearer in the following.

essential predicates may be ascribed to matter; this roughly mirrors the Kantian doctrines of phoronomy and dynamics. (3) The explanation of cognitive acts and intentional structures involved in apprehending something *given to* consciousness presupposes the account of what it even means/is for something to *be* 'outside,' as a spatial existence; this roughly corresponds to and overwrites the Kantian efforts at grounding his metaphysical doctrines by means of a transcendental-psychological framework and his view of space and time as pure intuitions lying at the core of transcendental idealism.

Hegel's treatment of these themes serves to redefine Kant's project from the ground up. The present section tried to broaden Hegel's criticisms of Kant's dynamical concept of matter and reveal their ramifications once they are construed as operating along the axes of spatiality and existence. Now, the next two sections will flesh out some details of the Hegels' recommendations for restructuring a metaphysical approach to natural science.

II. On the immanent connection of matter and motion (*Philosophy of Nature*)

We have already heard Hegel's complaints about the methodological dimensions of Kant's inquiry in the previous section. Now, we shall see how he takes up the central doctrinal elements of that inquiry, such as the connection of matter and motion, the accompanying discourses of space, force, and quantization, the phoronomical, dynamical and mechanical explications of matter, etc. This is done in the course of his presentation

of his theory of matter in the *Philosophy of Nature*, where Hegel rethinks matter and its connection with motion. The attribution of motion as a fundamental predicate of matter and the resultant concept of movable matter was seen to form the starting point of the Kantian project, even if the execution of this project was afflicted with several problems. Now, we need to see what alterations Hegel makes to this picture and how it bears upon the problems, as mentioned, lurking within that project.

Hegel's theory of matter is contained in the first part of his *Philosophy of Nature*, which he calls his Mechanics.[38] Here, matter is studied not merely as an object of outer senses as in Kant but as a system of relations grounded in space (whether this hypostatizes space as a causal nexus is not considered at present). That is, Hegel offers a decidedly non-subjectivist account of matter and he emphasizes how his discourse of space does not treat it as a subjective form of intuition like Kant. Consequently, matter too, as the occupant of space and as enclosing a system of relations that are addressed through the concept of motion, is not conceived from such a subjective standpoint alone. This non-subjectivist account is made possible by his philosophical architectonic, where *Naturphilosophie* follows upon a science of logic, which, in turn, has expunged all dichotomies of subjective and objective that afflict thought to yield a system of pure reason. It is impossible to tell the whole story of the development of this system here, but a few words locating the discourse on Mechanics in this context are in order.

Hegel's *Philosophy of Nature* follows upon his system of logic in his plan for the Encyclopaedia of the philosophical sciences. The nature of this 'following upon' is

[38] EN § 253-271; TWA 9: 41-108. I ignore the question of how Hegel's "Mechanics" fits with various historical senses of the term. For excellent historical accounts, see Meli (2006) and Gabbey (2002).

contentious and commentators disagree about how the *Philosophy of Nature* is related to the system of logic that precedes it. That is, even if one assumes for a moment that there is some degree of consensus as to what the system of logic itself amounts to, it is far from clear how the philosophy of nature is connected to it. That Hegel intends a connection is certain, but his spare words on the transition from the logical part of his system to the *Realphilosophie* do not permit any easy decisions. These problems of interpretation may be represented as a dilemma: If there is a seamless flow from the one to the other, then the philosophy of nature, which includes theoretical treatments of empirical phenomena like electricity and living organisms, becomes an a priori conceptual affair that absolutizes the contingent, which seems *prima facie* wrong; On the other hand, a strong distinction between the two demands sacrificing the fabled unity of the systemic whole of knowledge and seems to conflict with everything we think about Hegelian philosophy.

Accordingly, a compromise is sought, which permits both a transition as well as a distinction. That is, a partial identity and partial difference would be maintained between the two philosophic endeavors, and this is itself possible in two ways, depending on whether the identity-pole or the difference-pole is stressed: One may hold that the so-called pure conceptual realm of the Logic already contains extra-conceptual elements, so that the transition to the quasi-empirical realm of natural philosophy is not as shocking a transgression as one may first presume; Or one may uphold the apriority and conceptual purity of the Logic and see how this is carried over into the realm of natural philosophy with some modifications, albeit without any that would undo the conceptual purity. Edward Halper, Richard Dien Winfield, etc. represent the second option well,[39] and I am

[39] Halper's and Winfield's essays (cited below) are directly pertinent to my interest in the question of spatiality and matter in the philosophy of nature and their relations to purely conceptual determinations,

inclined to follow this route. I do not need to settle these thorny issues of interpretation for once and for all; my purpose through my comments on these approaches below is merely to secure a generally viable sense of the location of Hegelian mechanics in his overall theory.

II.1 Preliminary Remarks on Interpreting Hegel's *Naturphilosophie*

Without inaugurating a comprehensive inquisition into the systemic structure of Hegelian philosophy at this point, we should note first of all that Hegel does indeed accord a certain priority to the Logic in the system of philosophical sciences. That is,

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and so I will be making extensive use of these in my own analyses. Of course, I am not claiming to exhaust the field of Hegel literature with my schematic choices of readings; for overviews of the debates on various aspects of this topic of transition between formal-logical and natural-scientific parts of the Hegelian system, see Burbidge (2003), 168-172, Houlgate (2008), and Stone (2005), Ch.1.

The case for a *discontinuity* built into the end of the Logic, a discontinuity that then allows one to conceive of a distinction between the Logic and Realphilosophie as well as to enunciate the foundational status of the former vis-à-vis the latter, is made most elegantly in my opinion by Angelica Nuzzo. In a difficult essay, Nuzzo analyzes the culmination of the logic in the absolute idea becoming absolute method and describes Hegel's treatment of the topic as a response to a question about the externality of method: If the method was a merely external form, she argues, the immanent logical development of forms could in principle conclude anywhere since the method as form has nothing to do with this culmination, which would in that case belong to the object itself. Though she does not say this, this entails the strong *reductio* argument that such an arbitrary end could be placed right at the beginning too, making science altogether impossible. Further, if the method was a merely external form and not a necessary component of the end of the logical development, then this development, on account of the dialectical flux of negations that constitutes it, would simply be a sum of errors and truth would be impossible. Accordingly, the absolute method must institute a discontinuity between the logical development that preceded it and itself as absolute form and as end (the reference to self here ensures the non-externality of this discontinuity brought about by the absolute method) so that science and truth are possible. If this is the case, then a foundational value for all scientific inquiry (further sciences of the Realphilosophie) is secured by the same token. Cf. Nuzzo (2005).

while it is a part of the system of science (just because there are other parts investigating nature and spirit), Hegel thinks logic overreaches this partial status on account of handling a certain universality of topic whereas the other sciences handle only particular modes thereof.[40] This means that the Logic already contains what is treated under a certain aspect in the particular sciences and we need to specify the difference in aspect between the particular and universal scientific configurations. So the 'stuff' of the two sciences is indeed the same at some level and yet something *is* different, which has to be clarified. Of course, *how* this difference is brought about and *what* it is, are matters far from clear in Hegel's notorious descriptions (respectively):

> The idea, namely, in positing itself as absolute *unity* of the pure concept and its reality and thus contracting itself into the immediacy of *being*, is the *totality* in this form—*nature*. But this determination is not a *having-become*, nor is it a *transition*… On the contrary, the pure idea in which the determinateness or reality of the concept is itself raised into the concept, is an absolute *liberation* for which there is no longer any immediate determination that is not equally *posited* and itself concept; in this freedom, therefore, no transition takes place; the simple being to which the idea determines itself remains perfectly transparent to it and is the concept that, in its determination, abides by itself. The passage is therefore to be understood here rather in this manner, that the idea *freely releases* itself in its absolute self-assurance and inner poise.[41]

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[40] "[Die absolute Idee] ist der einzige Gegenstand und Inhalt der Philosophie. Indem sie *alle Bestimmtheit* in sich enthält und ihr Wesen dies ist, durch ihre Selbstbestimmung oder Besonderung zu sich zurückzukehren, so hat sie verschiedene Gestaltungen, und das Geschäft der Philosophie ist, sie in diesen zu erkennen. Die Natur und der Geist sind überhaupt unterschiedene Weisen, *ihr Dasein* darzustellen… Die Ableitung und Erkenntnis dieser besonderen Weisen ist nun das fernere Geschäft der besonderen philosophischen Wissenschaften. Das *Logische* der absoluten Idee kann auch eine Weise derselben gennant werden; aber indem die *Weise* eine *besondere* Art, eine *Bestimmtheit* der Form bezeichnet, so ist das Logische dagegen die allgemeine Weise, in der alle besonderen aufgehoben und eingehüllt sind. Die logische Idee ist sie selbst in ihrem reinen Wesen, wie sie in einfacher Identität in ihren Begriff eingeschlossen und in das *Scheinen* in einer Formbestimmtheit noch nicht eingetreten ist." (Hegel [1969], 824-825; TWA 6: 549-550; Cf. 58-59; TWA 5: 55-57).

[41] Ibid., 843; TWA 6: 573 (Trans. slightly modified): "Indem die Idee sich nämlich als absolute *Einheit* des reinen Begriffs und seiner Realität setzt, somit in die Unmittelbarkeit des *Seins* zusammennimmt, so ist sie als die *Totalität* in dieser Form – *Natur*. Diese Bestimmung ist aber nicht ein *Gewordensein* und *Übergang*… Die reine Idee, in welcher die Bestimmtheit oder Realität des Begriffs selbst zum Begriffe erhoben ist, ist vielmehr absolute *Befreiung*, für welche keine unmittelbare

> Nature has presented itself as the idea in the form of *otherness*. Since therefore the *idea* is the negative of itself, or is *external to itself*, nature is not merely external in relation to this idea… rather, externality constitutes the determination in which the idea is as nature.[42]

Clearly these are challenging passages and do not permit easy interpretation. The first obstacle here is the suggestion of a kind of divine or anthropomorphic agency inserted into the idea. If this is not handled at the outset, one is always struggling with the alleged excesses of a rampant idealism conjuring reality from thought, which has always turned off the not-so-devout of Hegel's readers. I cannot provide a complete interpretation here, but we can recall that Hegel's exposition of the absolute idea, to which the first of the passages quoted above belongs, follows upon his analysis of the idea in its cognitive dimensions (the theoretical and practical ideas) and it belongs as a whole to his doctrine of subjective logic. This reminder helps us see that Hegel is working with structures of *spontaneity* or the *act-character* of categorial determinations (to use Kantian or Husserlian vocabulary). What appears at first glance as the improbable "agency" of the idea should be made comprehensible by placing it into this context. I submit that Hegel's subjective logic (the second part of the *Science of Logic*)

Bestimmung mehr ist, die nicht ebensosehre *gesetzt* und der Begriff ist; in dieser Freiheit finder daher keine Übergang statt; das einfache Sein, zu dem sich die Idee bestimmt, bleibt hier vollkommen durchsichtig und ist der in seiner Bestimmung bei sich selbst bleibende Begriff. Das Übergehen ist also hier vielmehr so zu fassen, daβ die Idee sich selbst *frei entläβt*, ihrer absolute sicher und in sich ruhend." A few lines down, the passage to nature is described in terms of the idea's "resolve" (Entschluβ) to be so determined, while the idea and the involved cognitive dimensions are described as "divine" (*göttlich*). The talk of the absolute idea resolving (*sich entschlieβen*) to freely release (*sich entlassen*) itself is repeated at EL §244; TWA 8: 393. Also, cf. Hegel (1969), 592; TWA 5: 265: "[D]ie Logik [zeigt] die Erhebung der *Idee* zu der Stufe, von der aus sie die Schöpferin der Natur wird…"

[42] EN §247; TWA 9: 24 (Trans. modified): "Die Natur hat sich als die Idee in der Form des *Anderssein* ergeben. Da die *Idee so als das Negative ihrer selbst oder sich äußerlich* ist, so ist die Natur nicht äußerlich nur relative gegen diese Idee… sondern die *Äußerlichkeit* macht die Bestimmung aus, in welcher sie als Natur ist."

and its central item, which Hegel calls "the concept" (*der Begriff*), are names for various structures of spontaneity underlying the system of categories elaborated in the objective logic (the first part of the *Science of Logic*). The concept of the absolute idea is developed in the domain of subjective logic and accordingly bears this character of spontaneity.

Why does the subjective-logical sphere underlie the objective-logical in the first place? I can only briefly indicate the contours of an answer along these three points:

(1) Ground, Truth, Result: According to the Hegelian method of reasoning, the immanent progress of conceptual determinations through determinate negations means that the *result* of a segment is the negation of the foregoing. As such, it carries the signifcance of being the *truth* of the foregoing and the *ground* of its process. The subjective-logical sphere of the concept (*Begriff*) is the result of the dialectical exposition of the objective-logical determinations of being (*Sein*) and essence (*Wesen*). Consequently, the former is the ground and truth of the latter and Hegel explains it as such in the introductory section to the subjective logic called "On the concept in general."[43]

(2) Metaphysical Deduction: One of the aims of the subjective logic is to provide an improved version of the Kantian metaphysical deduction, i.e., something akin to the demonstration of the basis of the categories in forms of judgment. Hegel, like many others, complains that Kant merely picked these

[43] "Sein und Wesen sind insofern die Momente seines [des Begriffs] *Werdens*; er aber ist ihre *Grundlage* und *Wahrheit* als die Identität, in welcher sie untergegangen und enthalten sind. Sie sind in ihm, weil er ihr *Resultat* ist, enthalten… Die *objektive Logik*, welche das *Sein* und *Wesen* betrachtet, macht daher eigentlich die *genetische Exposition des Begriffes* aus… [S]ein *Werden* hat, wie das Werden überall, die Bedeutung, daβ es die Reflexion des Übergehenden in seinen *Grund* ist und daβ das… in welches das erstere übergegangen [ist], dessen *Wahrheit* macht." (Hegel [1969], 577; TWA 6: 245-246)

forms of judgment from the logic textbooks of his time, which amounts to an empirical 'rhapsodical' procedure of the sort he faulted other category-theorists like Aristotle for.[44] For his own part, Hegel wants to show how the categorial thought-determinations of objective logic have their grounds in the formal-logical determinations of subjective logic. To be sure, Hegel does not produce, like Kant, twelve categories corresponding to twelve logical forms of judgment; rather, the sum of his immanently developed scheme of categories across the objective logic possesses, in the form of a result, the logical forms developed by his theory of judgment in the first part of his subjective logic called, "Subjectivity."[45] The latter formal-logical functions show the inner composition of conceptuality, which, qua result of the objective logic, contains the ground-plan of the various categories. In Hegel's metaphysical deduction, then, there does not obtain a one-to-one correspondence between given categories and assumed logical forms of judging, but rather, the various species of logical combination are derived from a principle (about the structure of the concept or of spontaneity as function), which itself is the ground/truth/result of categorial determinations.[46]

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[44] See Hegel (1969) 613, 789; TWA 6: 289, 505 and EL §42R; TWA 8: 116-117.

[45] Cf. Burbidge (2003), 147-163.

[46] Hegel states that the pure thoughts of an object, pure predicates of objectivity as such or the categories, are aptly understood as objectifying *acts* of original apperception: "…das Objektiviren des Ich, als ein ursprüngliches und nothwendiges Tun des Bewußtseins anzusehen sei, so daß in diesem ursprünglichen Tun noch nicht die Vorstellung des Ich selbst ist, —als welche erst ein Bewußtsein jenes Bewußtseins, oder selbst ein Objektiviren jenes Bewußtsein sei, —so ist dieses von dem Gegensatze des Bewußtseins befreite objektivirende Tun näher dasjenige, was für Denken als solches überhaupt genommen werden kann." (Hegel [1969], 62; TWA 5: 60). Hegel continues: "Indem nun das Interesse der kantischen Philosophie auf das sogenannte *Transzendentale* der Denkbestimmungen gerichtet war, ist die Abhandlung derselben selbst leer ausgegangen; was sie an ihnen selbst sind, ohne die abstrakte, allen gleiche Relation auf Ich, ihre Bestimmtheit gegen und ihr Verhältniß zu einander ist nicht zu einem Gegenstande der

(3) Transcendental Deduction: I hold that another aim of the subjective logic is to yield something akin to the Kantian transcendental deduction. If we read the objective logic as enumerating a series of categories (*Denkbestimmungen*) that have a priori objective purchase, then we may read the subjective logic as explaining *how* these categories have objectively referring functions. The explanation proceeds by way of laying out the form of the concept and the structures of spontaneity, whereby those determinations are *constituted* into forms of "objectivity" and in accordance with the possibility of "pure truth."[47] The form of the concept (*der Begriff*), for Hegel, outlines the a priori

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Betrachtung gemacht worden." But it is necessary to turn to "die Betrachtung der formellen Seite, des Ich… d.i. der abstrakten Beziehung eines subjektiven Wissens auf ein Objekt, …[so] daß die Erkenntniβ der unendlichen Form, d.i. des Begriffs, auf diese Weise eingeleitet wurde."

Extending his criticism of Kant's table of categories to the system of transcendental principles that ultimately draw upon the same bases as the categories (unity of apperception and logical forms of judgment), Hegel says: "Indem Kant die tiefe Bemerkung von *synthetischen* Grundsätzen a priori aufgestellt und als deren Wurzel die Einheit des Selbstbewuβtseins, also die Identität des Begriffes mit sich erkannt hat, nimmt er doch den *bestimmten* Zusammenhang, die Verhältnisbegriffe und synthetischen Grundsätze selbst, *von der formalen Logik* als *gegeben* auf; die Deduktion derselben hätte die Darstellung des Übergangs jener einfachen Einheit des Selbstbewuβtseins in diese ihre Bestimmungen und Unterschiede sein müssen; aber die Aufzeigung dieses wahrhaft synthetischen Fortgehens, des sich selbst produzierenden Begriffs, hat Kant sich erspart zu leisten." (Hegel [1969], 789; TWA 6: 505)

[47] The "forms of objectivity" are discussed in a section by that name (the second section of the subjective logic, *Die Objektivität*) and they are shown to consist in configurations of totalities of objects. The subjective logic thus drafts the constitutions of types of objective arrangements in nature and these prefigurations of actual regional ontologies are named mechanical, chemical and teleological according to their distinct characters. Hegel also describes the derivation of the forms of objectivity as the basic logical operation that lies behind ontological proofs of existence (see Hegel [1969], 705-708; TWA 6: 402-405) and at one place suggests that the logic of the forms of objectivity lies behind and is perhaps best exemplified as a monadology (see EL §194R; TWA 8: 350). "Pure truth" is the province of the Hegelian idea (*Idee*), which is the speculative unity of forms of subjectivity (the formal-logical functions of thinking) with the aforesaid forms of objectivity. As this unity, the idea has the character of pure truth inasmuch as it enunciates the identity (correspondence) of concept and reality. Hegel describes the idea as expressing truth in this sense at Hegel (1969), 756-757; TWA 6: 463-465. In connection with the above suggestion of a monadological interpretation, it may be noted that the specific structure of the idea (most clearly elucidated by Hegel at ibid., 758-759; TWA 6: 466-467) is described as fundamentally a process and as a system of drives (appetites).

syntheses[48] necessary for such original formal-ontological constitution. He thinks Kant was on the right track with his theory of the original synthetic unity of apperception, which encapsulates the notion of such a genuine a priori synthesis. But the subjective-idealist orientation of his inquiry caused him to lose his way such that this a priori synthesis remained a formal subjective accomplishment conditioned by an alien objective content. That is, the categories for Kant remain empty logical functions without adding and adding together manifolds of intuitions. If, with Hegel, we recognize the form of the concept as precisely the a priori synthesis in its *complete* development that proceeds through the logical functions of judgment unto "forms of objectivity" and "pure truth," then this gap between categories and objective cognition is overcome just as a transcendental deduction hopes to do.[49] Thus, the subjective-logical grounds the objective-logical in this sense too.

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[48] Although, Hegel avoids the term "synthesis," whose etymology suggests an external joining together of givens. E.g., he says, "…der Synthesis der Sinn von einem äußerlichen Zusammenbringen äußerlich gegeneinander Vorhandener am nächsten liegt"; "Schon der Ausdruck *Synthesis* leitet leicht wieder zur Vorstellung einer *äußerlichen* Einheit und *bloßen Verbindung* von solchen, die *an und für sich getrennt* sind"; "…einer Synthesis, d.h. einer Einheit von solchen, die ursprünglich geschieden, nur äußerlich so verbunden seien…" (Hegel [1969], 96, 589, 784; TWA 5: 100, TWA 6: 261, 499).

[49] In some of his most important comments on Kantian philosophy, Hegel tells us: "Es gehört zu den tiefsten und richtigsten Einsichten, die sich in der *Kritik der reinen Vernunft* finden, daß die Einheit, die das Wesen des Begriffs ausmacht, als die ursprünglich-synthetische Einheit der Apperzeption, als Einheit des 'Ich Denke' oder des Selbstbewußtseins erkannt wird. —Dieser Satz macht die sogennante *transzendentale* Deduktion der Kategorie[n] aus…"; "Diese ursprüngliche Synthesis der Apperzeption ist eines der tiefsten Prinzipien für die spekulative Entwicklung; sie enthält den Anfang zum wahrhaften Auffassen der Natur des Begriffs…Alsdann ist die Kantische Philosophie nur bei dem psychologischen Reflexe des Begriffs stehengeblieben und ist wieder zur Behauptung der bleibenden Bedingtheit des Begriffs durch ein Mannigfaltiges der Anschauung zurückgegangen"; "So wie die Kantische Philosophie die Kategorien nicht an und für sich betrachte, sondern sie nur aus dem schiefen Grunde, weil sie die subjektive Formen des Selbstbewußtsein, für endliche Bestimmungen, die das Wahre zu enthalten unfähig seien, erklärte, so hat sie noch weniger die Formen des Begriffs, welche der Inhalt der gewöhnlichen Logik sind, der Kritik unterworfen; sie hat vielmehr einen Teil derselben, nämlich die Funktionen der Urteile für die Bestimmung der Kategorie aufgenommen und sie als gültige Voraussetzungen gelten lassen. Soll in dieser logischen Formen auch weiter nichts gesehen werden als formelle Funktionen des Denkens, so

The very least we learn from the above is that when Hegel talks of the "resolve" and the "free release" of the absolute idea into nature, he is indicating the mode of further development of the structures of spontaneity (the a priori syntheses) laid out so far. The idea (*Idee*), as mentioned, has been fitted out with drives and a processual character in general. The latter need not be taken in any vague sense for it was determinately explicated in terms of analytic and synthetic methods of cognition. The culmination of the logic in the absolute idea is the proper manner of this process as a whole because the absolute idea enunciates the totality of process, and as such it is the absolute *method*. We have already seen how a 'discontinuity' can be legitimately instituted within the immanent progress of conceptual determinations at the end of the Logic (see f.n. 39 above). Now, the discontinuity represented by the absolute idea/method should be thought in terms of the spontaneity that characterizes the entire section as I have claimed.

To see this, one must first understand that this end or break is a complex affair. At the same time that Hegel describes it as a simple return to immediacy and the self-relation of being (*Sein*), is is also thought from a number of sides that flesh out the concept of *end*. Inasmuch as the end, per the form of the concept, holds its extremes

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wären sie schon darum der Untersuchung, inwiefern sie für sich der *Wahrheit* entsprechen, würdig." (Hegel [1969], 584, 589, 595; TWA 6: 254, 260-261, 268-269 respectively.)

The Kantian background to this discussion, i.e., the links between the form of the concept, the logical functions of thinking, and the original synthetic unity of apperception, can be gleaned from a very important text in the B-edition of the Transcendental Deduction: "Die analytische Einheit des Bewuβtseins hängt allen gemeinsamen Begriffen, als solchen, an, z.B. wenn ich mir **rot** überhaupt denke, so stelle ich mir dadurch eine Beschaffenheit vor, die (als Merkmal) irgend woran angetroffen, oder mit anderen Vorstellungen verbunden sein kann; also nur vermöge einer vorausgedachten möglichen synthetischen Einheit kann ich mir die analytische vorstellen. Eine Vorstellung, die als **verschiedenen** gemein gedacht werden soll, wird als zu solchen gehörig angesehen, die auβer ihr noch etwas **Verschiedenes** an sich haben, folglich muβ sie in synthetischer Einheit mit anderen (wenn gleich nur möglichen Vorstellungen) vorher gedacht werden, ehe ich die analytische Einheit des Bewuβtseins, welche sie zum *conceptus communis* macht, an ihr denken kann. Und so ist die synthetische Einheit der Apperzeption der höchste Punkt, an dem man allen Verstandesgebrauch, selbst die ganze Logik, und, nach ihr, die Transzendental-Philosophie heften muβ, ja dieses Vermögen ist der Verstand selbst." (B133-134n.)

together, contains in itself its dialectically explicated terms, it is an "expansion" (*Erweiterung*) that answers to a moment of content produced by the method. The following must be thought together: (i) The closure of the logic as a *self-determining comprehension according to the form of the concept* that ranges over all thought-determinations is a return to immediacy as such and the self-relation expressed as being (*Sein*), but also (ii) the *closure of the logic itself according to the form of the concept* holds together the entire stretch onward from the beginning until itself, and in this regard it is an "expansion" (*Erweiterung*) that expresses the system as content. The one stresses the abstract beginning by itself and the other the abstract end by itself, but together the two capture the self-transcedence that Hegel wants to bring out in the structure of the absolute idea as absolute method.

In other words, the complexity of the end is thought as a self-transcendence when viewed as a component of subjectivity and drives as such. Qua drive, i.e., qua the spontaneity-structure that *is* act *toward* and *in* the end, the closure of the logic expands into the system of science but also upon the terms of another beginning and in another sphere. Hegel says of this expansion unto the new sphere that it is neither a transition nor development of the sort encountered in the course of the Logic. As a function of the closure whereby full transparency has been brought about between the concept and its object (itself) in the absolute idea, there is no more transition between disparate terms simply because there is no more disparateness. Accordingly, in one and the same stroke the system of science is inaugurated and sheer abstract immediacy is given. The absolute idea is an act of production, to be sure, but of the *system* of *Denkbestimmungen*, not of the natural world; at the same time, the absolute idea as just this systemic structure of

spontaneity is self-related and extinguishes every determination as an isolated one – as such this totality simply *is*. I believe Hegel's talk of the idea freely releasing itself and of nature as the idea in pure otherness refers to this doubled state of affairs.[50]

Thus, the absolute idea in otherness *is* nature as it remains other to the system of thinking thinking itself. But since it remains other in this way *through* the latter's own spontaneity, this also means that nature exists utterly outside and on its own account.[51] We can put this another way: The idea-as-end contains otherness in itself just as the *undetermined* state of two-sidedness of the idea as being and method. As idea, however, it is ultimately a function of spontaneity and self-*determination*, and from the perspective of spontaneity, the otherness of the idea to itself in that two-sided indeterminacy is something outside the idea's determin*ing* field, something that does not belong to its all-encompassing process or method. In this respect, the idea-as-end is a passive being

[50] Cf. Winfield (1998), 52-53: "This notoriously perplexing formulation [of the transition from Logic to *Naturphilosophie*] presents the emergence of natural determinacy as the outcome of the presuppositionless development of a determinacy in general that relies upon no reference to what is given in reality nor to any determining structures of knowing. By characterizing the threshold of nature as the self-externality of logical determinations in their totality, Hegel's formulation moreover seeks to arrive at a minimal determination of nature that, on the one hand, makes use of no resources other than the logical categories that have arisen from indeterminacy without assumption, and yet, on the other hand, employs the same categories so that they comprise a determination that remains distinct from every last one of them. The difference of nature, by which it is irreducible to thought, is accordingly a pure difference, a difference defined in terms of nothing but thought itself…[and] the totality of thought can stand distinguished from something other than itself…only by arriving at its own totality related to itself as an other. Although each side of the relation may well add nothing to logical determinacy, their relationship, that of self-externality, involves more than either logical totality or any of its component features." Edward Halper arrives at a similar position from a slightly different set of premises that involve the notion that the idea is a concept that explicates its own transformation qua concept and hence is not transformed into anything further. Yet, there remains a difference-without-transformation between the absolute idea as a *category* by form and as the *transformative course of all logical categories* by content. In respect of *this* difference, "absolute idea is indifferent and external to the processes of conceptual unfolding that constitute logic. It is precisely this *externality* of absolute idea's form from its content that defines the realm of nature. So it is that absolute idea, in being just what it is, is also something else." (Halper [1998], 32)

[51] Hegel (1969), 843; TWA 6: 573: "…die Idee sich selbst *frei entläßt*… Um dieser Freiheit willen ist die *Form ihrer Bestimmtheit* ebenso schlechthin frei, —die absolut für sich selbst ohne Subjektivität seinde *Äußerlichkeit des Raums und der Zeit*." Cf. Burbidge (2007), ch. 7, esp. pgs 104-105.

lacking rational order or active but random. From the perspective of the content of the idea, which is wholly determined in and for itself and *one* with its form for that very reason, that two-sided indeterminacy is something that simply lies beyond self-determination through the idea. It is therefore both the idea dispersed into an indeterminate extraneity as well as the idea as a totality of determinations along with the brute fact of being-exterior.

All these descriptions refer to nature as a sum of determinatenesses (*Bestimmtheiten*) that exist in exteriority. Significantly, this nature is the outcome of a self-relating structure of spontaneity, which means that the same functions of spontaneity that establish the totality of formal-logical determinations are also constitutive for the existence of things. *How* the constitution of things in nature proceeds per the ideality of formal-ontological composition is the story told by the *Philosophy of Nature*. But *so far as* the result of the logic *alone* is concerned, this constitution of nature is the outcome of the function of spontaneity and self-determination. Accordingly, the self-enclosed structure of spontaneity lets us think of this constitution in ways reminiscent of Kantian self-affection, although, to be fair to Hegel, we should exorcise the psychologistic undertones in the latter in doing so. Kant, as we saw in the previous chapter, tried to construe external affection through self-affection. By contrast, Hegel's claim seems to be that natural constitution and determinations of existence for types of given things, while comprehensible in terms of formal-logical/-ontological categories, are irreducible to the latter and, as enuciating a separate plane of being, are coterminous with them as their necessary consequence.[52]

[52] Hegel even makes the striking claim, which, incidently, stands opposed to either of his great philosophical predecessors, Aristotle and Kant: "…so liegt das Hervorgehen der Natur aus der ewigen Idee,

The philosophical task of comprehending this plane of being is described in the *Philosophy of Nature* from two perspectives: once from the side of ordinary theoretical and practical dealings with this entity (which prefigures in immediacy the system of self-determining thought just as the absolute idea itself arose as a mediating unity of theoretical and practical cognition-drives), and then from the side of concept-constitution, which undergirds all methodological philosophical undertakings according to the logic of system.[53] Both of these discussions show that nature is not unconditioned and is rather *externality-as-posited* and hence contains the seeds of overcoming the contradiction of the idea externalized. The second perspective, however, allows us to systematize the method of thinking through this contradiction, thus conceiving nature as a "system of stages," and per the form of the concept, through the determinations of singularization, particularization and subjectivitation.[54]

The development of this conception through *natural categories* brings back the gamut of difficulties about whether and how these categories really differ from logical ones, whence their supposed contingent externality comes in from if they are at bottom identical with the logical categories as to their 'stuff' but differ in form, how the externality of natural-philosophical determinations really differs from various logical categories described as having the character of externality (e.g. even the isolated and

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ihre Erschaffung, *der Beweis sogar, daβ notwendig eine Natur sei*, im Vorhergehenden (§244 [This refers to the closing paragraph of the *Encyclopaedia Logic*])." (EN §244Z; TWA 9: 10; my italics).

[53] The former is discussed under the title, "Betrachtungsweisen der Natur" (§§ 244Z-246Z; TWA 9: 11-23), and the latter under the title, "Begriff der Natur" (EN §§ 247-252Z; TWA 9: 24-40) in the Introduction to the *Philosophy of Nature*.

[54] EN §§ 249-250, 252; TWA 9: 31-36, 37-40.

fixed conceptual determinations of the understanding studied under the heading 'subjectivity' in the subjective logic), etc. I won't pretend to sort through this range of difficulties as I explained earlier; I will merely refer to competent remarks by Halper and Winfield on the topic that suffice to place it in relation to certain specifics of the Kantian project of enunciating similar metaphysical categories for the sake of a rational physics.[55]

For both Halper and Winfield, with some difference of detail, the development of the natural categories takes place on account of the starting point of the philosophy of nature – the concept of nature as the determination of the idea in its otherness. Halper describes this point of departure as a conjunction of the logical categories, *absolute idea* and *being*, where the result of being "yoked together" acquires an extra-logical significance.[56] We have already heard Winfield's description of the point of departure (f.n.70 above), which too amounts to a conjunction of logical categories carrying an extra-logical significance, only that he specifies this conjunction as a self-relation and the logical relata conjoined on his account are the absolute idea and itself. There remain questions on either account – e.g. the 'being' that Halper 'adds' to absolute idea is supposed to itself be extra-logical by not being the same as the first logical category of being (*Sein*) and Halper, in his otherwise excellent analysis, fails to satisfactorily address this de facto deferral of the question of extra-logicality; similarly, it is not obvious how Winfield thinks the relation of the absolute idea to itself as a case of "self-externality," a

[55] Earlier, we saw how the *Metaphysical Foundations* aspires to a rational physics (see my Ch.2 above, esp. the textual references in its f.n.3). Now, care should be taken in regard to the different use of this term by Hegel, for whom the *Philosophy of Nature*, properly speaking, just is rational physics (EN §244Z; TWA 9: 10-11), which is distinguished from empirical physics just as in Kant, but also contains particularizations into various 'matters' and constitutions of living beings, very much unlike Kant.

[56] Cf. Halper (1998), 33-35.

relating of something to itself as other, which in any case remains within the categories of being (*Sein*) that Hegel has described in great detail in his *Science of Logic*. Nevertheless, these worries are not objections to their analyses, but further questions first made possible by them.

The course of the development of natural categories for both Halper and Winfield follows from their choice of starting points, and this development mirrors the logical progress of categories (especially those of being [*Sein*]) to some extent for both, again with some difference in detail. For Halper, according to whom the starting point in the philosophy of nature is the conjunction of the absolute idea with being, the development is roughly driven by the inadequacy of the latter conceptual determination (being) to the former (absolute idea). This development roughly takes place as transformations in *how the absolute idea is expressed through its determination* rather than the merely logical transformation of the determining categories themselves as in the Logic.[57] For Winfield, the situation is a little different, since it is not the inadequacy of the relata composing the concept of nature that impels a progressive enrichment of determinations to achieve adequacy, but rather the development of natural categories is the immanent unfolding of the determinations of *this inadequacy itself as a concept* (self-externality). The progress of natural categories occurs as further determinations through an immanent dialectical path, whose starting point is the concept of self-externality articulated as space.

[57] Halper (1998), 36-37: "[A]bsolute idea has been determined as an 'immediate being'…The determination's inadequacy to the concept it is supposed to express constitutes the basis of an inner dynamic [that propels further development through a series of determinate negations]… [T]he determinations are not generated from each other as in the *Logic*; rather they arise from the absolute idea."

This further determination, according to Winfield, reflects the dialectical progress through logical categories (e.g. being [Sein]-nothing [Nichts]-becoming [Werden]-determinate being [Dasein]), although in a somewhat superficial way and only at certain junctures (e.g. the emergence of "matter" from "space" reflects the emergence of "determinate being" [Dasein] from "being" [Sein]). The correspondence with the sequence of logical categories is more substantive in Halper's view, because one of the relata of the conjunction is the category of being (*Sein*) that can be (and is) logically developed whereas the other relatum, absolute idea, is already completely developed. More importantly, and this is pertinent for my purposes, the distinctive characteristic of the development of natural categories is that this takes place upon the fundamental basis of space. For Winfield, this is directly the case because the unfolding of the natural categories just is a dialectical explication of the concept of space alone. Only in this way can the unfolding be accorded a truly immanent character that does not import any extraneous determinations. Halper arrives at the same result through fundamentally similar means, while involving a slightly more indirect approach of generalizing over the nature of the sequence of natural transformations as a whole. In his words:

> [T]here remains an insurmountable otherness between the concept, that is, the absolute idea, and the determination of determinate being that expresses it; and the more that we try to distinguish the concept from this determination as something other, the more we determine it as other and the more ways in which its otherness comes to be expressed. Ironically, the attempt to distinguish absolute idea from its determination results in new determinations of it—but determinations of the same sort, namely, determinations of otherness, spatial determinations.[58]

[58] Halper (1998), 42.

Thus, both Halper and Winfield view the *Philosophy of Nature* as having grounded the natural categories in that of space, and conversely, showing that all natural categories contain spatial determinations or at least rest upon them insofar as they are ultimately related to the condition of otherness dominating all natural categories. Hegel too states that "natural objects are in space, which remains their basis, because nature lies in the bonds of externality."[59] This grounding of all natural categories in space returns us to our topic of interest, the procedural resonance with Kant's metaphysical explication of natural philosophy. As I have said, Hegel's method loosely resembles Kant's construction as a presentation of concepts (or the concept, *der Begriff*, the structure of spontaneity) in the element of space. Of course, for Hegel, unlike Kant, space is not just a form of intuition dependent wholly on subjective constitution.[60] So, construction cannot be thought as the presentation of a concept in *intuition* a priori. I will take up the question of Hegel's position on spatial *intuition* in section III dealing with psychological matters; with the above expositions in place, we can now talk more directly about the Hegelian procedure in relation to Kantian construction from the point of view of the spatial element as such in the following sub-section.

[59] EN §254Z; TWA 9: 43: "[D]ie Naturdinge sind im Raume, und er bleibt die Grundlage, weil die Nature unter dem Bande der Äuβerlichkeit liegt."

[60] EN §254R; TWA 9: 41-42: "Ich erwähne nur der Kantischen Bestimmung, daβ er [der Raum] wie die Zeit eine *Form* der *sinnlichen Anschauung* sei. Auch sonst ist es gewöhnlich geworden, zugrunde zu legen, daβ der Raum als etwas Subjektives in der Vorstellung betracthet werden müsse. Wenn von dem abgesehen wird, was in dem Kantischen Begriffe dem subjektiven Idealismus und dessen Bestimmungen angehört, so bleibt die richtige Bestimmung übrig, daβ der Raum eine bloβe Form, d.h. eine *Abstraktion* ist, und zwar die der unmittelbaren *Äuβerlichkeit*." For a record of Hegel's various reflections on space in relation to the Kantian theory of space, see Inwood (1987).

II.2 Hegel's Mechanics in Relation to Aspects of Kant's Theory of Matter

Let us recapitulate some of the main points of the discussion so far. We need to explore some key moments of Hegel's Mechanics that articulate the connection of matter and motion and can thus provide critical insight into Kant's troubles with the same. Before entering the details of this articulation, we tried to locate Hegel's Mechanics in the context of Hegel's philosophic architectonic. As the first part of his *Philosophy of Nature*, it stands at the crossing over of the Logic into the *Realphilosophie*. Accordingly, we tried to understand this juncture by comparing some fairly representative views in Hegel scholarship and also by keeping in mind resonant critical epistemological strategies in Kant's texts. Careful attention to the way Hegel's Logic ends and the *Philosophy of Nature* begins reveals that a certain logic of natural constitution is coeval with the production of systematic self-relation and enclosure among logical *Denkbestimmugen*. By trying to understand the concluding concept of Hegel's Logic, the 'absolute idea,' in terms of structures of spontaneity that his subjective-logical doctrine elaborates, we were able to make some initial headway into the difficult topic of transition from logic to nature in Hegelian philosophy.

Especially with a view to the Kantian background of present interest, two things stood out – first, the Hegelian reformulation of Kantian "construction" inasmuch as the *Philosophy of Nature* roughly presents the concept as such in the element of pure exteriority or space; and second, the Hegelian reformulation of Kant's "self-affection," an explanatory device for reading all affection in Kant's hands, which Hegel uses to think

natural constitution roughly as both a corollary to the system of science and a component of spontaneity. These two concepts have deeper connections in Kant's theory, since it is precisely the latter aspect, namely, Kant's hopes for being able to address all outer affection through the pure imaginative syntheses in intuition a priori through self-affection, which instructs the former aspect, namely, his hopes for producing a mode of proof for the concepts of determinate natural things through mathematical figurations in pure intuition. That is, Kant wants to produce a mathematically fortified theory for basic natural kinds via his doctrine of self-affection, which promises to handle both outer sensible affections and pure geometrical configurations with formally the same set of epistemic functions. It remains to be seen how Hegel tackles this issue in working out his theory, which we have seen to announce its concern with it in preliminary ways already.

I believe this can be made clearest by following out his theory of space and the grounding of the concept of movable matter in the structure of space. Here, we find Hegel distinguishing between the concepts of geometric, absolute, and relative space, and finding only the last of the three relevant to natural-philosophic interest. On the basis of his concept of relative space, which he presents without any appeal to the empirical embededdness of perception in its background, as we saw (give rise to difficulties) in Kant, Hegel is able to predicate motion of matter as essential to it. He is able to avoid various worries implicit in Kant's presentation of concepts such as "empirical space," as well as those that afflict Kant's detour through geometrical constructions to uphold his phoronomical principles. Without calling things by their Kantian names, Hegel effectively provides a persuasive account of the theoretical framework for the metaphysics of given physical things (in Kant, the 'definition' of 'movable matter') and

its connection with a phoronomical theory of matter (in Kant, the metaphysical explication of this definition in regard to experience). Not only this, but Hegel also provides his own (corrective) interpretation of the links between phoronomical and dynamical concepts of matter and of how the discourse of forces serves to think matter as a system of spatial relations.

Hegel's concept of space, first of all, is not only the concept of an extreme abstraction but is also itself an extremely abstract concept. That is, it does not refer to a given item in the way that the Kantian concept of space does, e.g, when Kant analyzes the representation of space in the four *Raumargumente* of the Transcendental Aesthetic, which is at least supposed to be a familiar item to us although it is not clearly stated whether this is drawn from everyday experience and legitimated thusly, or if it is the space of the (Euclidean) geometer, or something common to both, or the least contentious set of received notions of the age about it, or a possibly contentious dogma of a particular philosophical school that Kant is comfortable with, etc. Hegel, however, is explicit about the fact that he is unpacking the abstraction of 'universal asunderness' under the title of space and wants, now and then, to show where this abstract unpacking coincides with our ordinary representation of space without indicating any more substantive connections between the abstract concept and the ordinary representations answering to it.[61]

[61] Cf. EN §254Z; TWA 9: 42. A cursory inspection of Hegel's very first remarks makes it apparent that he intends a deft improvement upon the aforesaid reticence of the Kantian presentation. Kant arrays the features of space in his analysis according to the four headings of the table of categories, without mentioning this. This does not have to mean anything more than that it presumably ensures a certain completeness of the analysis just as we saw him explicitly claim for the similarly arrayed analysis of matter in the *Metaphysical Foundations*. In any case, the four *Raumargumente* (of the B-edition) proceed according to Modality, Relation, Quality, and Quantity, and characterize space as a necessary subjective presupposition, universal objective condition, unitary as homogeneous, and an infinite given quantity, respectively (Cf. Baum [1992], 303-305, [1991], 65-66, [1996], 47-48). It is not entirely clear on Kant's presentation whether, e.g., the first argument really depends on the context of an Euler-Crusius debate to complete its meaning (cf. Baum [1996]), or if Kant means to rely on the geometric postulate of an infinitely

Whatever else may be said about this lack of connection, it certainly means that a wedge is driven between the abstract exposition and any relevant empirical elements and the former requires no support from the latter. One will come across more meaningful references to experience in the course of the *Philosophy of Nature* as the natural categories are progressively determined in more concrete ways and enveloped in appearance-structures. But as for now, the exposition of space (and the axiomatics of movable matter that are developed in the Mechanics chapter on this basis and as the framework for general physics in the sequel) remains disengaged from experience.[62]

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extended line or on the geometric proof of infinite divisibility of space instead in order to assert the infinity of space in the fourth, or if the impossibility of blanking space combined with the possibility of blanking objects in space relevant to the 2nd *Raumargument* is a mere 'epistemic reflection' in Kenneth Westphal's sense or if it refers to the late Aristotelian tradition of conceiving 'imaginary space' through thought experiments about global annihilation that persist through to Hobbes' *De Corpore* and Descartes' *The World*, etc. In contrast, Hegel's very first remarks (cf. EN 254§R; TWA 41-42) address all these features: he describes space as the *possibility of being-outside-one-another*; a *given* insofar as it is the immediate determination of the totality of nature; as *quantity* insofar as this determination ensues from the mediation of being as such and as its sublation is an external indifference to being which defines quantity; and this active absencing of difference is understood as a continuity that is used to infer its *homogeneity* and *infinity* in the precise sense of infinite divisibility. In all this, Hegel of course abstains from including subjective factors such as are important to Kant's first *Raumargument* for instance, because he is not specifically interested in the thesis of transcendental idealism and is only interested in the determinations of space as such and clarity about the premises from which these are developed immanently-conceptually. Thus, he can even allow talk of space and time as forms of sense and intuition while stressing its irrelevance to his present exposition (and it will be so for us too until we come to this issue in section III): "Die Zeit ist wie der Raum eine *reine Form* der *Sinnlichkeit* oder des *Anschauens*, das unsinnliche Sinnliche, — aber wie diesen, so geht auch die Zeit der Unterschied der Objektivität und eines gegen dieselbe subjektiven Bewuβtseins nichts an." (EN §258R; TWA 9: 48)

[62] Even matter, which in one respect signifies the given external sensible object in general for Kant, is here treated by Hegel as only a configuration of abstract spatio-temporal relations, and whose sensible qualities have absolutely no place in this exposition. Hegel says: "Der Übergang von der Idealität zur Realität, von der Abstraktion zum konkreten Dasein, hier von Raum und Zeit zu der Realität, welche als *Materie* erscheint, ist für den Verstand unbegreiflich und macht sich für ihn daher immer äuβerlich und als ein Gegebenes… Was von der Materie gesagt wird, ist, a) daβ sie *zusammengesetzt* ist; — dies bezieht sich auf ihr abstraktes Auβereinander, den Raum… eine solche Materie ist auch nur ein unwahres Abstraktum. b) Die Materie ist *undurchdringlich* and leistet *Widerstand*, ist ein Fühlbares, Sichtbares, usf. *Diese Prädikate sind nichts anderes* [my italics], als daβ die Materie teils für bestimmte Wahrnehmung, überhaupt *für ein Anderes*, teils aber ebensosehr *für sich* ist." (EN §261R; TWA 9: 56-57) It may thus be said that, for Hegel, matter, which in one respect represents in the Kantian formal-transcendental story the first step towards content and reality, is, to still choose a Kantian designation though in another respect, addressed through the "*allgemeinen Begriff der Materie überhaupt*."

Such a discourse of space, therefore, does not make reference to the perception of anything like an empirical or relative space, even where it makes reference to concepts such as relative space, matter's movability, etc. It remains a wholly rational construct, *even as* the necessity of the existence of natural determinations has been allegedly proved across the Logic as a whole, various correspondent ordinary representations are easily pointed out, and its subjectively conscious uptake will be the topic of the Phenomenology and Psychology later. So how indeed does Hegel address the concept of relative space, if not empirically?

For Hegel, *absolute* and *relative* spaces are defined in terms internal to the conceptual determinations that delineate *space as such*. The latter names indifferent externality, abstract universal juxtaposition. But there is an inner contradiction in the state of affairs this signifies; the unthinking abiding of this contradiction signifies absolute space whereas its dialectical resolution signifies relative space; subsequently, Hegel develops elements of phoronomical-geometrical propositions in tandem with this concept of relative space while circumventing any geometrical constructions of that concept, which we found to generate difficulties for Kant. But to begin with: inscribed in the concept of space as such is the coupling of an abstract externality with an indeterminate universality in the sense of limitless iteration, which signifies a possible infinite dispersal. At the same time, no determinate difference is present in this dispersal, which is thus simply indifferent both to itself and to anything else, whatever these may be. The dispersal and the in-difference, however, are mutually opposed, because the lack of determinate difference entails unity across the insufficiently distinguished elements of dispersion.

One way to deal with this opposition is to distinguish the two sides as we have just done; thus, it may be said that there is distinction *and also* unity, and this is the situtation in the concept of absolute space, where one after another, the one and the other determination is invoked. One form of such infinitely serial invocations would be the way Kant described the logical idea of absolute space as the assumed condition of a constantly recursive series of relative spaces.[63] Hegel's own example is that of the universality of the "here,"[64] which signifies discreteness and distinction as an indexical *and then also* universal reiteration elsewhere, but this is just another form of the same infinitely serial invocation. *Another way* of dealing with this opposition would be to think a unity of the two sides.[65] This thought leads to the concept of relative space by means of considering the intrinsic unity of space with time in the concept of motion and matter as the subject of this unity.

> The unity of these two moments, discreteness and continuity, is the objectively determined concept of space. This concept, however, is only the abstraction of space, which is often regarded as absolute space. This is thought to be the truth of space; but relative space is something much higher, for it is the determinate

[63] Cf. MFNS 195; Ak.4:481-482. Also see my Ch.3, f.n.1 and the discussion in the main text.

[64] Cf. EN §254Z; TWA 9: 42-43.

[65] I will take as understood *that* this is how Hegel deals with 'contradiction' and I will not ask after his philosophical reasons for treating contradiction as fundamentally a moment or case of an overall synthetic a priori structure of unity. For an elegant account of how Hegel puts this thought to use in considering the Zenonic paradoxes of motion as a context for treating Kant's *Phoronomy* as a way of dealing with the contradiction at the heart of the concept of motion (itself only a first externalization of the contradiction that underlies thinking as such in virtue of the said a priori synthetic unity), which lies midway and partially successfully between the ancients who did not grasp the inner unity across contradiction and his own thought that successfully does so – see de Laurentiis (2005), Ch.6.

> space of some material body. It is rather the truth of abstract space to exist as a material body.[66]

Outlined thus, this line of thinking is very close to the Kantian definition of movable matter as I reconstructed it (Ch.2), but it does not issue from the transcendental imagination in any quasi-psychologistic sense of self-affection, even as it yields a similar range of insights to the mathematical-phoronomical reflections Kant achieves thereby. Let us see how Hegel's procedure of thinking the dialectical linkages of spatio-temporal determinations arrives at these results. Central to this is the stated need to think the unity of the opposed determinations of dispersal and unity, of discreteness and continuity, but importantly, to do this and at the same time to incorporate a number of geometric concepts such as dimensionality and quantitative elements on the one hand, and on the other, to produce a concept of motion as essential to matter. The determination of space as a natural category, although quite abstract at this stage compared with, say, the discourse of physical elements and inorganic formations later, thus acquires its foundational unity. This "metaphysical foundation" of natural philosophy is

[66] "Die Einheit dieser beiden Momente, der Diskretion und Kontinuität, ist der objektiv bestimmte Begriff des Raums; dieser Begriff ist aber nur die Abstraktion des Raums, die man oft für den absoluten Raum ansieht. Man denkt, dieses ist die Wahrheit des Raums; der relative Raum ist aber etwas viel Höheres, denn er ist der bestimmte Raum irgendeines materiellen Körpers; die Wahrheit des abstrakten Raumes aber ist vielmehr, als materieller Körper zu sein." (EN §254Z; TWA 9: 43) A few clarifications can be made here: (1) the context makes clear that the "unity" mentioned in the very first words of this passage is not yet the "still higher" unity to be discovered through the dialectical exegesis of the former; (2) when Hegel talks of the "objectively determined concept of space," again, the context makes it clear that he is talking about space as such in contradistinction from the subjective idealist (Kantian) concept of space; (3) "relative space," to begin with, is only what is usually meant by place, a local spatiality essentially contingent upon determinate material occupation – but because place, for Hegel, is essentially connected with a movable matter as we will see, relative space too acquires the proper Kantian sense of the space relevant to movable matter.

characterized by the determinate existence of matter as mass and fundamentally addressed via geometrical concepts which are constitutive for it.[67]

The first thing is to think how opposition (and subsequently unity) not only characterizes the concept of space as such (indifferent externality) but how this makes its appearance in the content of the concept itself *as a set of spatial determinations*. This has two aspects: first in regard to the indifference that characterizes all natural categories,[68] distinction is given as the plurality of dimensions, and second, in regard to the essentiality of distinction itself, this goes against the concept of space itself as the ignoring of the essentiality of distinction in its concept of 'indifferent externality.' Hegel endeavours to prove amongst other things that not only is the three-dimensionality of space a superficial manifestation of the triadic essence of concept-as-such, but also that it is grounded upon the latter, and thus that the second of the two moments above is really the crucial one.[69]

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[67] How this mathematical-phoronomical determination, evidently still quite abstract, responds to Kant's main challenge about having these determinations answerable to outer experience – this worry of course remains on Hegel's account as presently pursued and we shall tackle it in the following Section III, which deals with psychological-epistemological matters.

[68] "In dieser Äußerlichkeit [which "macht die Bestimmung aus, in welcher sie [die Idee] als Natur ist" (EN §247; TWA 9: 24)] haben die Begriffsbestimmungen den Schein eines *gleichgültigen Bestehens* und der *Vereinzelung* gegeneinander; der Begriff ist deswegen als Innerliches." (EN §248; TWA 9: 27)

[69] Cf. Wandschneider (1975) for an excellent commentary on this issue, upon which I rely for my own analysis. It should nevertheless be noted that his account is slightly marred in the following ways, which doesn't refute but should rather provoke further study/strengthening of his thesis: (1) because the account in the *Philosophy of Nature* is "sehr knapp formuliert," Wandschneider relies on secondary material from Hegel's lectures, especially for the crucial assertion that the point must be related *to another point*, whereas the text of the *Philosophy of Nature* goes only so far as to state that the point is related *to space as such* (and even Hegel's reinterpretation of the proposition that "the straight line is the shortest distance between two points" seems to work by dissolving any reference to a plurality of points altogether; cf. EN §256R; TWA 9: 46); (2) for the sake of his reconstruction, Wandschneider must identify the Hegelian concept of continuity of space (which is, after all, a very innocent concept affirming the non-distinctness or inessential and hence non-binding distinctness of parts of space vis-à-vis each other) with Cantor's concept of continuity of space (which is a much thicker concept distinguished from mere density and relying on a particular understanding of infinity), which may or may not be a good assumption, but this is precisely the worry; (3) Wandschneider attempts to show that the explicitly stated superficiality of there being 'three' dimensions because the Hegelian concept has 'three' essential-structural moments (Cf. EN

Therein,[70] one begins with the immediate fact of how distinction properly negates the concept of space itself as we said, and this negation of space is named "point." But the point so defined is also a relation to space and thus itself a spatial determination. Just this self-canceling point as the relation to externality as such answers to the common geometric postulate of an extended line in general (i.e., a line (and only a line) may be produced from a point), and in particular implies that points are found only in or on a line, if we can understand the line as a spatial relation of point(s). But, the concept of a line now leads to the concept of a plane, because the line is essentially a negation of a point and in being this negation it negates its own element or principle. Now, in the realm of externality in which this train of thought proceeds, the negation of a point and a line as external and negative towards each other can only be understood as engendering a planar surface that 'contains' a line and a point as distinguished or opposed. Finally,

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§255 and Z; TWA 9: 44) has its deeper unstated grounds in the way the dialectic of the conceptual structure unfolds as spatial determinations – now this is fundamentally correct as an insight, but a crucial assumption of Wandschneider's is that the third moment (of self-identifying 'return' after the first two of 'line' and 'surface') inolves a third dimension too just because this refers to a whole space, i.e., space as volume – but I don't think that this assumption is fully guaranteed by Hegel's thought in these passages, which only requires an "enclosed surface," which can mean both a volume but also just a *two*-dimensional figured area (Hegel exploits just this very ambiguity in the subsequent discussion) and the second possiblity does not permit the inference to a *third* dimension for space according to the concept. As I said, these are uncertainties rather than mistakes in Wandschneider's analysis, which is on the whole correct. Also cf. Hösle (1987), 261-265.

[70] In the following paragraphs, I am paraphrasing Hegel's "sehr knapp formuliert" and famous passage about point, line, plane and space. My interpretation is slightly different from Wandschneider's and avoids the difficulties mentioned in the previous footnote while also shedding clearer light on the transition from *line* to *plane* than his account (cf. op.cit. 266-267). Hegel's passage states: "Aber der Unterschied ist wesentlich bestimmter, qualitativer Unterschied. Als solcher ist er 1. zunächst die *Negation* des Raums selbst, weil dieser das unmittelbar *unterschiedslose* Auβersichsein ist, der *Punkt*. 2. Die Negation ist aber Negation *des Raums*, d.i. sie ist selbst räumlich; der Punkt als wesentlich diese Beziehung, d.i. als sich aufhebend, ist die *Linie*, das erste Anders-, d.i. Räumlich*sein* des Punktes; 3. die Wahrheit des Andersseins ist aber die Negation der Negation. Die Linie geht daher in *Fläche* über, welche einerseits eine Bestimmtheit gegen Linie und Punkt, und so Fläche überhaupt, andererseits aber die aufgehobene Negation des Raums ist, somit Wiederherstullung der räumlichen Totalität, welche, nunmehr das negative Moment an ihr hat; — *umschließende Oberfläche*, die einen *einzelnen* ganzen Raum absondert." (EN §256; TWA 9: 44-45)

because the line as a negation of a point is also just a negation of negation (since the point was essentially a negation of space), the result is also a restoration of space as a whole.

So, a planar surface that is a spatial whole is the third moment to the point and the line in the system of determinations of difference qua spatial. Hegel leaves this moment ambiguous: it can be either a closed figure (think determinate area) or an enclosing surface as a three-dimensional solid (think determinate volume). With the former he can, for instance, talk about the importance of the triangle as the first closed figure in space and the philosophical significance of geometrical theories in regard to it according to such a priority, and with the latter he can, for instance, talk about the necessary three-dimensionality of space according to the triadic essence of the concept. In any case, the gist of the story is that the development of difference in space returns us to the starting point of space as indifferent externality although we have now learnt that this is in itself structured through self-relating negativity. And *this* self-relating negativity of the whole and as an ideal unity, but posited beside or outside the system of spatial determination in the realm of externality that still characterizes natural categories at this point, is "time."

Hegel's dialectical explication of the concept of time as it leads through concepts of place and motion to the concept of matter as thus movable is not as well defined as the above discussion of the structure of space, and one rightly suspects that many a sleight of hand guides one along the way. Before continuing in that direction, however, let us stress about the above account that despite Hegel's several assertions about the need to distinguish geometrical or mathematical (as essentially external operations of the Understanding) from philosophical knowledge (as the immanent movement of Reason), those geometric figurations are constitutive for the present philosophical account. Now

this may be because the given stage of thinking deals with abstract externalities such as space, time, motion, and matter, such as to allow easy conflations between the two; yet whatever the grounds, the conflation is indeed present. Further, Hegel implicitly allows that his philosophical account also provides geometry with some of its foundational spatial elements in this manner, since geometry as a particular science has to receive these determinations from elsewhere as its presuppositions.[71]

At the same time, these determinations are objective-conceptual categories and are not drawn from experience and do not have any irreducibly experiencable quality for content. They are, to be sure, not merely logical categories, and as natural, they represent externally subsisting determinations, but still they do not carry any necessarily phenomenological charge (using the term in the 'phenomenology-lite' sense as doing no more than pointing to a familiarity from and faithfulness to experience). This means that the spatial structures uncovered here, which will inform the theory of matter and motion, remain products of mathematical reflection (and as we said above, some of these mathematical products are given to mathematics from philosophical reflection) without necessary connection to objects of experience or even to space as we experience it. Hegel's establishment of the framework of mechanical principles, therefore, specifies

[71] EN §255R; TWA 9: 44: "Die Notwendigkeit, daβ der Raum gerade drei Dimensionen hat, zu deduzieren, ist an die Geometrie nicht zu fordern, insofern sie nicht eine philosophische Wissenschaft ist und ihren Gegenstand, den Raum mit seinen allgemeinen Bestimmungen, voraussetzen darf." In all of this, let us remember that the precise place of mathematics in the Hegelian system is a matter of lasting worry – his encyclopaedic arrangment seems to have no particular place for the discipline of mathematics as it allots one to everything else, it is not clear whether the logical categories of quantity suffice to generate the object and method of mathematics or whether a natural-philosophical detour through space is first required for this, etc. For a helpful first account of the deeply vexing questions in this regard, which I will happily ignore for now, see the discussions in Hösle (1987), esp. 255-258, 265-273, 286-292.

geometrical aspects of natural-conceptual categories without incorporating an epistemological story about how we apprehend them (at least not at this point).

Notice that on this view geometrical determinations, wherever they themselves acquire their own peculiar *geometrical* values (and not merely the philosophical-conceptual imputations), do not serve a rational physical account through the mediation of quasi-psychological reflections on how we consider lines and circles. Kant's definition of movable matter, if my reconstruction of this is plausible enough, appeals to the doctrine of inner or self-affection to procure purely rational value and then proceeds to paint over this some sensational-perceptual imagery to procure empirical purchase. By Hegel's method, this mediation is unnecessary and we develop the rational physical bases directly from a conceptually fortified geometrical/mathematical account. At the same time, however, Hegel also holds that only by means of an empirical analysis can we arrive at certain determinations of importance for a rational grounded physics. This belief not only underlies his particular criticisms of Newton's hypostatization of forces (which are ultimately merely mathematical regularities for Hegel) but also informs his mechanics.

> The name of mathematics could also be used for the philosophical treatment of space and time. But if it were desired to treat the forms of space and the unit philosophically, they would lose their peculiar significance and pattern; a philosophy of them would become a matter of logic, or would even assume the character of another concrete philosophical science, according as a more concrete significance was imparted to the notions. Mathematics deals with these objects only *qua quantitative*, and among them it does not—as we noted—include time itself but only the unit variously combined and linked. No doubt in the theory of motion time *is* an object considered, but applied mathematics is, on

> the whole, not an immanent science, simply because it is the application of pure mathematics to a given material and to its empirically derived determinations.[72]

How this does not contradict what was said earlier about the theoretical framework for mechanics being wholly rational-mathematical and where precisely the reference to experience does actually make itself felt – these are questions we will have to face and they also give us a productive critical template for reading Kant's problems with similar moments of his theory. But for now I return to our immediate interest in Hegel's concept of relative space.

We had followed Hegel's reflections upon the contradictory conceptual make-up of space and seen how a particular shape of this contradiction is defined as time; a corresponding analysis of the conceptual elements of time shows that it *is* only as the external indifference of space.[73] *This* space is a unity that includes contradiction and not merely the alternation of one opposed term (discreteness) after the other (continuity) as was the case with absolute space. It has two characteristics, determinate geometrical

[72] EN §259Z; TWA 9: 55: "Der Name Mathematik könnte übrigens auch für die philosophische Betrachtung des Raums und der Zeit gebraucht werden. Wenn man aber die Figurationen des Raumes und des Eins pihlosophisch behandeln wollte, so würden sie ihre eigentümliche Bedeutung und Gestalt verlieren; eine Philosophie derselben würde etwas Logisches oder auch etwas von einer anderen konkreten philosophischen Wissenschaft werden, je nachdem man den Begriffen eine konkretere Bedeutung erteilte. Während die Mathematik nur die Größenbestimung an diesen Gegenständen, und von diesen auch, wie erinnert, nicht die Zeit selbst, sondern nur das Eins in seinen Figurationen und Verbindungen betrachtet, so wird in der Bewegungslehre zwar die Zeit auch ein Gegenstand dieser Wissenschaft, aber die angewandte Mathematik ist überhaupt keine immanente Wissenschaft, eben weil sie die Anwendung der reinen Mathematik auf einen gegebenen Stoff und dessen aus der Erfahrung aufgenommene Bestimmungen ist." For Hegel's criticism of Newton's use of the concept of force, see EN §267ff; TWA 9: 75ff and Ihmig (1993a) and (1993b).

[73] "Der Raum ist in sich selbst der Widerspruch des gleichgültigen Auseinandersein und der unterschiedslosen Kontinuität, die reine Negativität seiner selbst und das *Übergehen zunächst in die Zeit*. Ebenso ist die Zeit, da deren in eins zusammengehaltene entgegengesetzte Momente sich unmittelbar aufheben, das unmittelbare *Zusammenfallen* in die Indifferenz, in das ununterschiedene Außereinander oder *den Raum*." (EN §260; TWA 9: 55)

figuration (from the analysis of dimensionality) and temporal content as negativity (from mediation through the concept of time). This space is called "place" (*der Ort*) and it is what Hegel means by relative space insofar as it is a self-differentiating determinate locality, or in other words, the space of a body. Unpacking its conceptual content lets us see how this concrete spatiotemporal unity is also the space *of* movable matter.

In a series of quick moves, Hegel tells us that the concept of place leads to the concept of motion as a change of place on account of the self-differentiating negativity that place contains in the form of time. The inclusion of the latter component is the distinguishing mark of Hegelian *place*, which makes it not only a spatial concept but also that of an event.[74] It is a dynamic unity whose moments yield us the concepts of matter and motion, and at the same time, the first condition of their identity, difference, and relation. The immediate mutual interrelatedness of the moments through the self-differentiating negativity just is motion and the equally immediate positivity of the result for itself just is matter. At this point, there is only an abstract identity of the two – matter and motion are only two sides of the same unity of the place-event. But motion will be further determined as will be matter, such that we see the proper concretion of motion in matter. Without the dialectical construction of that concretion, matter and motion are (notionally) separable aspects of the event, even as one understands their synonymous co-implication.

[74] As Wandschneider ([1986], 353) notes: " 'Ort' hat für Hegel also, in Abweichung vom geläufigen Sprachgebrauch, nicht nur räumlichen, sondern *raum-zeitlichen* Sinn und entspricht so in etwa dem physikalischen Begriff des 'Ereignesses'." This is important in view of the general direction of our analyses so far, for it may be read as Hegel's suggestion to Kant to relinquish the phoronomical treatment of matter and motion in accordance with the problematic principle of the Anticipations of Perception, but rather to treat that subject matter qua an essentially unified spatio-temporal form that falls under the jurisdiction of the Analogies of Experience, which can handle entities like events or objective successions.

Whatever else this signifies, we can interpret it in light of Kant's 'definition' of matter as movable and its phoronomical working out.[75] Recall that Kant's notion of relative space already presupposes matter as movable and tries to show how the relativity

[75] Wandschneider (1986) ingeniously argues that this synonymy (his preferred term is "gleichbeteund") amounts to a philosophical justification of the classical kinematic principle of the relativity of motion and also opens the way to the latter's fundamental revision in the Einsteinian theory of special relativity, which holds the speed of light to be non-relative or absolute. His reason for thinking so is essentially that the said synonymy implies that every case of rest (such as is matter or the place-event [Ort] for itself) is at the same time a case of motion, such that every frame of reference (posited at rest) can be viewed as moving. This just is the classical relativity principle about motion, which is finally justified, for Wandschneider, through Hegelian dialectics and not just asserted without argument, as has been the custom since Galileo. He notes, "Selbst Kant unternimmt in seiner Schrift 'Metaphysische Anfangsgründe der Naturwissenschaft,' die eine Klärung und Grundlegung der metaphysischen Voraussetzungen der Physik zum Ziel hat, keinen Versuch, das Relativitätsprinzip zu begründen." ([1986], 352). The gleichbeteund equivalence of matter and motion, however, only holds for *corporeal* matter, such that a non-corporeal form of matter (light) is exempt from this relativity, and this makes possible the concept of an absolute motion for light at the same time (ibid., 354ff). I believe there are reasons to press Wandschneider on several points of his claim, but I will not do so here; however, it is relevant to my analysis to register concern about his abovementioned Kant criticism in this context: As my previous chapter showed, the entire first chapter of Kant's text revolves around this principle, which I have called Kant's "phoronomical principle" all along (his Grundsatz 1; Wandschneider elsewhere admits that this *Grundsatz* indeed represents the classical relativity principle, but holds Kant guilty for remaining content merely "diese Tatbestände nur äußerlich zu konstatieren, ohne sie prinzipien-theoretisch zu begründen." [1987b], 295 & cf. 295n.5). But let us be clear about what is and what is not argued for in this principle. The mere fact that motion is relative to a chosen frame of reference, which may be itself be taken as moving in another instance – this much is argued for by Kant on the basis of treating motion as an object of experience in empirical, relative, material hence movable space. According to Wandschneider's reading, Hegel may at best be said to have argued for this much too but without incurring the empirical imagery that infects Kant's account of relative space. What Kant did *not* argue for and simply inserted into the phoronomical principle was the fact that the equivalence of two states of affairs rests on assigning *the same quantity of motion* to one or the other term, either to the object or to the frame of reference. This aspect seems to be the crux of the relativity principle and it is deplorable that Kant not only did not clearly argue for it in setting up his phoronomical principle but also went on to 'construct' the concept of motion as a quantum upon this (non-)basis. On the other hand, nowhere do I find in Hegel's Mechanics, whether according to Wandschneider or Hegel himself, any argument for this *quantitative* function between equivalent states of motion-affairs. The truth, it would seem, is that neither Kant nor Hegel addressed this crucial part of the relativity principle. At the most, both may have articulated the simple case where the same given motion may be equivalently said to belong to one or the other term of the object-reference frame complex; but that a part of this motion may be given to the one, a part to the other, other conditions applying – this is merely stated by Kant and not even mentioned by Hegel; if this is assumed to be a trivial inference from the equivalence that they may claim to have articulated, then still nothing more is said by Hegel than by Kant. If one wants to insist, then it may be said that Hegel is better placed to make the last claim because his Mechanics deals with these concepts (space, time, motion) in purely quantitative terms, whereas Kant wanted to prove the very applicability of concepts of quantity to motion, but there are significant problems about Hegel's blithely quantitative standpoint in this sphere that we have already set aside in ignoring the question of where mathematics lies as a discipline in Hegel's encyclopaedic system (and why then, e.g., in this quantitative sphere are the logical categories of quality such as limit, being-becoming, etc. invoked rather than the logical categories of quantity).

of motion results from the relative space in which motion is perceived. The reference to perception is essential because this subjects Kant's relative space to the sensative conditions of perception, whereby alone does relative space itself count as material and hence movable. Hegel's concept of relative space, on the other hand, is not the space of sense-perceived motion but rather of the conceptually constituted place-event. All the terms of Hegel's Mechanics derive from progressive determinations of this place-event, including the definitional equivalence of matter and motion; the latter is not presupposed for it, but rather is its result. Yet, the Hegelian account persists with the phoronomical framework of Kant's theory insofar as matter here is taken as a purely quantitative term without any inner characteristics or distinct properties aside from being a subject of motion. Not until we plumb the arcane depths of Hegel's Physics do particular qualities and properties accrue to matter, which I forego from doing here.

Now, perhaps it is possible on this basis to develop an account of the relativity of motion in the manner of Wandschneider, albeit with modifications (f.n.75). But if we focus on the Kantian context, a different story emerges, one about Hegel's belief that the purely phoronomical-quantitative analysis of matter itself leads (through a dialectical progression) to an understanding of matter's essentially dynamic constitution. This story aims to outline the conditions and consequences of the relation of matter and motion, from an abstract identity (definition of matter as movable) through a relation of indifference (inert matter) to the proper relation of identity (matter as a system of moving bodies). One can, if one wants, develop an account of the relativity of motion to freely chosen frames of reference by artificially abstracting and combining certain Hegelian items from this dialectical progression. But the progression, on its own strength, purports

to show the necessity of treating the solar system/any planetary system as a unique/privileged frame of reference necessitated by the concept of movable matter itself.

The details of this story need not detain us. It is important, however, to note the principle of the dialectical progression outlined above: the abstract definitional identity of matter and motion as forms of spatio-temporal unification under the concept of place needs to be understood as only a first condition of the proper identity of matter and motion such that motion is not merely a contingent property of matter but its essential form; matter essentially moves. In the course of this progression, Hegel's contempt for the notion of forces as separately existent natural beings becomes evident, since they are for him nothing more than expressive of the logical relations arising from the quantitative treatment of matter and motion across the aforementioned stages. Thus, the dynamical constitution of matter need not invoke these as irreducible givens as on Kant's view and follows from purely phoronomical considerations (and even includes interactional moments that Kant assembles under his heading of "mechanics.") This means that not only does Hegel show how to 'enact' Kant's definition of movable matter without slippage between predicable and empirical senses of terms, but also how the appearance of movable matter is a deficient mode of the matter-motion relation and how the dynamical constitution of matter is of a piece with its phoronomical analysis. A brief comment on these aspects is in order.

Hegel's concept of motion as such or even the abstract equivalence in virtue of spatio-temporal constitution underlying the concept of movable matter is clearly what Kant would think of as a predicable. But 'motion as such' is determined differently in what Hegel calls finite and absolute mechanics, and room is made among these

determinations for motion *as it appears* (to us), on account of the fact that motion is not 'for itself' but 'for another' in some of these forms.[76] As such, we have heard, motion is merely change of place contained in the concept of place, which, in turn, is the actuality of a distinction in space resulting from the inclusion of a temporal dimension in it. Matter as such just is this place in space identified on account of motion as such. This is the abstract equivalence of matter and motion, falling under a familiar brand of Cartesian material-monism. It is only with the inherent differentiation of places/matters that we are able to speak of a plurality of matters, whose composition and decomposition is addressed in purely quantitative terms. Since the unity of matter as to its formal intuition in space and time (in the specific character of motion) is not yet upon the scene, these matters appear as the content of space and time and matter appears to be indifferent to the unity of motion (or rest as its nominal negation), an *inert* spatio-temporal occupant or mass.[77]

Obversely, motion here is merely a formal unity that has not achieved proper substantial identity in matter and thus preserves a dimension 'for another' or for perception. Motion-as-perceived is described by Hegel as rectilinear, the result of a cause external to the matter that is its subject (since it is not yet bound up essentially with the latter) and a simple quantitative relationship of its spatio-temporal moments in speed. These characteristics are ascribed to motion partly on account of the dialectical unraveling of the natural categories of space and time and partly on account of observed

[76] Recall Hegel's similar presentation of the sensible aspects of matter; see my f.n.62 above.

[77] EN §263-264; TWA 9: 64ff.

phenomena, although it is clear from Hegel's remarks, e.g., on the increasingly complex determinations of motion as curved as we progress through projectile motions or elliptical as we progress to planetary systems, etc., that these determinations are neither deduced from concepts directly (even though some essential marks are supplied for them this way[78]), nor should one expect to cover all phenomena from direct conceptual derivations. Broadly, the simpler determinations of physical point—matter/line—motion/speed—quantitative relation give way to more complex determinations of spherical systems/circular motions/ratio-of-powers qualitative relations. The various sensible *and* phoronomical elements of interest to Kant are enunciated by Hegel thus on the basis of his predicable-analysis of movable matter.

Similarly, Hegel completes his critical comments in the *Science of Logic* on the dynamical constitution of matter, which we studied in the previous section of this chapter, by explaining fundamental 'forces' on the same basis: these are nothing but representations of the said merely quantitative composition and decomposition of the plurality of matters in a convenient form. They enter the mechanical vocabulary with the concept of inert matter that requires an external impetus and this, in turn, requires thinking of matters in contact (for Hegel, this is the same as for Kant: spatially determined reciprocal interaction of repulsions); in the concept of contact, the plurality of matters is notionally suspended, motion as mere speed is combined with the body in the concept of momentum, and a certain ideality enters the picture (where, by ideality, Hegel means the essentiality of a relational viewpoint over and above a one-sided adherence to the related terms); forces help designate this moment of ideality even though at bottom

[78] Cf. EN §261Z; TWA 9: 59.

they are nothing more than specific configurations of spatio-temporal unities of placed masses.[79]

Further, Hegel thinks this moment of ideality as itself a driving motor of the entire dialectic of matter in the concept of gravity, which is not merely the abstract force of attraction as opposed to repulsion, but the first immediate, then reflected, material existence of an organized system of matter that answers to its original concept – that of a self-contained singularity (physical place) which essentially moves (free or uncaused motion inherent in the concept of matter). Gravity is understood as an essential predicate of matter and culminates – the sequence of natural categories having traversed various phases of concretizations of matter and motion such as freely falling bodies – in the system of universal gravitation. Here, motion as that which constitutes matter as a totality of spatio-temporal relations and matter as that which manifests the real existence of the dialectical interplay of ideal spatio-temporal parts are made identical, and we have arrived at the proper concept of movable matter.[80] Again, I have sacrificed the fascinating details of Hegel's account in order to bring into view its coherence with the Kantian theory. I will now proceed without delay to the final epistemological-psychological aspects of this dialogue.

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[79] EN §265Z; TWA 9: "Indem die Massen aber einander stoβen und drücken und kein leerer Raum dazwischen ist, so ist es nun in dieser *Berührung*, daβ die Idealität der Materie überhaupt beginnt… [In the concept of elasticity that names the reciprocal interplay of repulsions as such] erscheint uns zunächst das Fürsichsein der Materie, wodurch sie sich behauptet, als Innerlichkeit (die auch Kraft genannt wird) gegen ihre Äuβerlichkeit, d.h. hier Sein-für-Anderes, d.i. In-ihr-Sein eines Anderen. Die Idealität des Fürsichseins ist, daβ ein Anderes sich in der Masse geltend macht und sie sich in Anderem. Es zeigt sich diese Bestimmung der Idealität, die von auβen zu kommen schien, als das eigene Wesen der Materie, das selbst zugleich ihrer Innerlichkeit angehört; deswegen geht die Physik zur Reflexionvorstellung der Kraft über."

[80] EN §§269-271; TWA 9:82-108.

III. Knowing Material Nature (*Philosophy of Mind*)

In the previous sub-section we saw how Hegel works with the natural categories of matter and motion. Seen against the Kantian background, Hegel's exposition of the grounding concepts of Mechanics (inert and movable matter, types and paths of motions, gravity, material systems, etc.) completes his criticisms (in the *Science of Logic*) of Kant's dynamical concept of matter as a play of fundamental forces as well as offers an explicit account of the connection of matter and motion. The two issues are related: it is on the strength of the essential unity of what initially only seem to be co-terminous notions (matter and motion) that Hegel can outline his more unified presentation of phoronomical and dynamical theories. In this, no reference was made to theories of transcendental imaginative syntheses and self-affection to generate the conceptual field of spatio-temporal configurations that forms the bedrock of Hegel's analysis.

To be sure, the same principle was operative here as there, i.e., a combination of spatial and temporal terms underlies both Kant's and Hegel's accounts of the basic metaphysical concepts for the sake of a rational physics, but Hegel chose to stress the dialectical-conceptual interconnections over Kant's somewhat psychologistic proclivities in elaborating the principle. While the dialectical approach, and especially the key innovative inclusion of time in the concept of space as a differentiating factor, gained much by way of cogency, it seemed to equally lose something in regard to the empirical

dimension that was of primary concern for Kant. Due to the general character of externality that pervades Hegel's Mechanics, the appearant character of its central items too was generally established, but no more. However, he fleshes out this dimension, namely, how natural configurations are given in experience and to the knowing subject, in certain texts in his *Philosophy of Mind*.

In its chapters on Phenomenology and Psychology, Hegel develops some epistemological ideas that resonate with the said Kantian concern and this sub-section will cast a quick glance over these. Without pretending to do full justice to these ideas, I will merely try to highlight here the strongly empiricist flavour of Hegel's psychology as it nonetheless tackles the problem of knowing concrete nature a priori and what this tells us in light of the Kantian. Since the Hegelian texts considered in this context are embedded in the later portions of the Philosophy of Mind, and since they are not only focused on the knowledge of material nature but knowledge more generally, I will choose a more selective approach to bring out the above moments without adhering closely to the order of Hegel's exposition as I have done so far.

Let me begin by clarifying what I am referring to as the strongly empiricist approach that Hegel's psychology appears to endorse. Drawn with large gestures, this means that Hegel uses several motifs common to empiricist accounts of concept acquisition, such as the abstraction from sensed particulars to yield general representations, a sort of nominalism that usually accompanies such abstractive accounts, and the sort of psychologistic stories about the genesis of meaning through conscious attention that too are found there.[81] I have already mentioned that in these chapters on

[81] Hegel's reasons for adopting this approach possibly lie in the fact that he finds contingency and arbitrariness built into the natural-psychological scene as such, which mirrors the externally separated

Phenomenology and Psychology Hegel proceeds with an eye upon Kantian transcendental psychology and its account of various synthetic, self-affective acts; but, more importantly, Hegel treats this too in an empiricistic fashion because he seems to blur the Kantian division between pure, original apperception and empirical introspection. Finally, if it had seemed that Hegel avoided the obscure Kantian imagery of perceiving empirical spaces of motion in his dialectical construction of phoronomical primitives, a similar sort of obscure imagery returns in Hegel's talk of releasing the sensible particular from external spatio-temporal specifications into an 'inner,' parallel set of relations in abstractive mental retention. The overall thrust of Hegel's said chapters is to show a certain progressive and recursive 'inwardization' that informs intelligence or concrete thought and the production of a conceptual or discursive realm. This implies, again speaking in general terms, that the apparently given becomes a conceptual possession and the strict subject-object opposition of the former gives way to a universalistic unity of the latter.

There are two aspects of this approach that are directly relevant to our purposes. First, the 'inwardization' story does not seem to be very far from Kant's own 'self-affective' one, at least insofar as they both seek to reformulate sensible apprehension of the empirically and contingently given in intra-mental structural terms (rather than, say, in causal terms or empirical psychological terms) and that this is shown in the course of arguing for an internally unified *action* of various *faculties*. In fact, the way in which

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existence peculiar to nature, while the rational systematization thereof requires (or is) the emergence of self-consciousness proper under whose arrangement these various elements lose their necessary contingency: "...was in der physischen Natur die Grundbestimmtheit ist, das Außersichsein, die Momente der immanenten Vernunft außereinander darzustellen, das Vermag in der Intelligenz teils die Willkür, teils geschiet es ihr, insofern sie selbst natürlich, ungebildet ist." (EM §445Z; TWA 10: 243)

Hegel deals with sensation as a cognitive item about which certain a priori claims might be made is remarkably similar to the problematic Kantian doctrine of the same (even as there are key departures as I will show in the following). But, second, what *does* distinguish Hegel's account is its insistence on a continuity between empirical and transcendental self-consciousness; whereas Kant's separation of the two entailed that the latter remains a necessarily possible source of a priori synthetic unity and requires a schematization of the categorial conditions of that unity in order to apply to objects of experience, Hegel's interpretation of the a priori unity of self-consciousness as immanent to actual, empirical perception and imagination obviates the detour through transcendental imagination even as it simultaneously makes possible a realm of purely conceptual application.

These two aspects of the inwardization of received content and of immanent apperceptive activity that allows for purely conceptual expression are registered in Hegel's reworking of the key items of Kant's theory, intuition and imagination. We are asked, on the latter's view, to see these as intrinsic moments of an *actual* self-conscious activity that defines mind, and not as separable actions plotted along a Kantian faculty-psychology. In historical terms, Hegel's story of the production of mental content as the enactment of the form of self-consciouness seems to incorporate the substantial unity of the Cartesian cogito with the differentiated system of Kantian faculties that function under the formal, abstract unity of self-consciousness.[82] Because of this, Hegel is able to

[82] For the account of mind as cogito or the certainty of its existence in virtue of thinking, see §413&Z; TWA 10:199-200; for the basic stance of Kantian philosophy in light of this form of mind, see §415R; TWA 10:202-203; for the Kantian stance as adopting a faculty psychology and its overcoming (recommended by Hegel) in a substantial unity as that of the cogito, see §440R, §445&R; TWA 10:229-230, 240-243.

elucidate the unitary work of mind without dividing its labours among separate departments under the condition of a possibly self-affective relation. Conversely, Hegel reads the self-affective model of mind in non-faculty-psychological terms as a unitary action of self-consciousness, in which intuition (as mental stuff according to form and content) and imagination (as the agent of this process) feature as moments. For us, it becomes interesting to try and specify *where* the spatio-temporal form of intuition meets with the conceptual-dialectical arrangement of the natural categories of space and time and how the work of the imagination situates mental content at the conjuncture of the two.

I said that Hegel's account cleaves to Kant's own doctrine of the Anticipations of Perception inasmuch as it tries to articulate a priori cognition in regard to sensation. But Hegel avoids the obscurities that marred Kant's doctrine, most crucially the talk of the diminishing of consciousness that Kant used to confer quantifying properties upon the sensed content. He is able to do so by separating various stages of sensation from each other, principally by separating (1) the moment of sensation that reflects the natural transitions between wakefulness and sleep from cognitively engaged ones that are themselves distinguished according to (2) whether sensation merely and affectively indicates the givenness of an object to consciousness or (3) if it is substratively involved in the spatiotemporal, intuitive specification of its content.[83] The intrinsic qualities of sensation themselves have no a priori import for Hegel[84] as for Kant and in each instance

[83] For the first, cf. EM §§399ff; for the second, cf. §418; for the third, cf. §§446-449. Also cf. §§380, 381Z passim; TWA 10:16-25 passim.

[84] One may object by reminding us of Hegel's notorious 'derivation' of the five senses from sheer rational necessity (§401Z; TWA 10:102-106), but I do not mean this in speaking of the a priori import of sensations; rather, I mean what sensations tell us about their reference and not the classification of

only announce the initiation of a reflexive cast of mind.[85] The difference from Kant emerges in specifying the cognitive significance of sensation according to the various grades of sensation so isolated.

The third of these grades is relevant to our interests, for here the reference of sensed stuff to space and time becomes pertinent (whereas, as mentioned, the earlier grades merely announced the givenness to a subject either of its own natural constitution as such or of an immediate, singular object over against consciousness). The determinations that appear here, then, are also those that would be informative in some way of the determinations that exist in nature as we have already seen in considering the dialectic of space and time, and the question is about how this information is relayed. Hegel's claim is that mind in this phase is the actualization of self-consciousness (as the result and truth of consciousness) and this consists minimally in absorbing the immediacy of otherness that structurally afflicts consciousness into the unity of self-consciousness (where we notice the similarity of this moment with the self-affective model in Kant). Intuition figures as the first moment of this absorption; the content is present as sensation, but self-relation proceeds through the form of "attention" (*Aufmerksamkeit*), which contains within itself *its* other.

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sensations themselves as to their corporeal(ized) sources, and about the former Hegel is clear that this is an entirely contingent and particular connection, i.e., not a priori. So far as sensation is considered in the second stage, i.e., in regard to the intentional structure of consciousness studied in the Phenomenology, no other *Gedankenbestimmung* aside from those announcing immediacy and givenness of being are relevant to it (§418Z; TWA 10: 207).

[85] On the latter topic, however, Hegel is clearer than Kant was in both the first *Raumargument* of the Transcendental Aesthetic as well as in regard to the nature of the indicative relation that obtains between sensing and the sensed.

The form yields intuition as a projection of otherness into space and time, because otherness in its own self *is* space (and time) at the same time that the attentive internalization in mind generates an internal representation as a copy. This 'genesis,' a natural 'happening' in the empiricist approach is further developed or involuted through retentive acts towards conceptuality as such, which we can leave aside. What is of essential importance here is that the moment of externality that is thematized *as such* in apprehending an immediate, given sensed content through attention recalls the natural categoreal development of *externality as such*, which we studied in the previous section as the dialectic of space and time. The retentive-iterative psychological conditions of conceptuality proceed through imagination and memory, according to Hegel, in such a way that the possibility of a pure semiotic grammar and pure discursive cognition is secured, which, not least, explains the very conditions of transcendental reflection upon consciousness as such.[86] But equally importantly, the division enforced in and by mental attention between mere affection and the (complex, internally well-developed) world of meaning is *conditioned by* the system of natural categories given through the dialectic of space (and time).

[86] It is in this sense that Hegel does bootstrap himself in a way that Kant cannot. Kant cannot explain the possibility of his transcendental investigations, i.e., he cannot articulate within the theoretical structure of the *Critique of Pure Reason* the place of the philosophically reflecting subject who stands above the subject engaged in cognition and at the most can only negatively leave a place open for this subject in the architectonic of pure reason in terms of considering rational determinations in regard to the mere possibility (not givenness) of the object. Hegel, on the other hand, can (or so goes the claim until further verification outside the scope of this study) reflect on the reflecting subject precisely by conceiving self-consciousness (the highest point of *all* thinking according to Kant) as not only a necessarily possible and implicit but an explicit productive component of consciousness. In this sense too, the Philosophy of Spirit is the condition of the Logic, for Hegel, and concrete psychological thinking enables pure thinking (cf. Winfield [2007-8] for an excellent overview of this topic). I should add, however, that I am not entirely clear about how this avoids the absurdity or implausibility of a constantly self-aware subject.

This means, for our inquiry, that the application of categories in general to given objects of experience, which recollection, imagination, and conception are responsible for, is conditioned by the mechanical complex as such. More precisely, self-consciousness and proper *thinking* concerning sensation (in the very first instance, because sensation figures as singular, existent immediacy for consciousness) depends upon the unity of space and time as singular, existent immediacy as such, or in terms of what Hegel had termed 'place' (*Ort*) and its direct results in the discourse of matter and motion. While this is only an approximate and initial response that needs to be worked out in much more detail elsewhere, it would stand as Hegel's response to the dilemmas we uncovered in Kant's phoronomical account and which essentially pointed back to the Anticipations of Perception: Hegel's suggestion would indeed be to relinquish hopes for either 'constructing' matter as a subject of a quantum of motion generally by recourse to perception or for affirming quantitative necessities constraining the object of sensation in order to explain the fundamental empirical fact as matter in general; he would have urged instead that Kant provide a theory of matter as movable (according to the categories no doubt, regardless of the adequacy of his lists and tables vis-à-vis Hegel's system of categories as nature-encoded) as the condition of his theory of sensation.

IV. CONCLUSION

This dissertation has in essence studied some relations between two texts by Kant – the *Critique of Pure Reason* and the *Metaphysical Foundations of Natural Science* – and some of Hegel's criticisms of Kant's efforts as registered in sections of his *Science of Logic* and the *Encyclopaedia*. The goal through this was to shed some light on the concepts of matter and motion as they operate in a particular slice of Kantian metaphysics. I believe such a study performs some necessary groundwork toward any implementation of Kantian perspectives in the contemporary philosophical scenario. The latter, taken in a relevant and restricted sense, illustrates a basic empiricist orientation along with heavy doses of philosophical naturalism. Loosely speaking, the empiricist orientation consists in an interest in schemes of epistemic justification that preserve a strong role for experience and the naturalist orientation provokes discussions of the very role of philosophical thought and its coherence with regard to empirical scientific theorizing. Put this way, Kantian philosophy is motivated by a resonant range of issues in an important way, even if its official response by way of formal, transcendental idealist doctrines arranged in a more or less rationalistic system is not in style.

For a thorough evaluation of Kant's own attempts to tackle these concerns, a good place to go was the *Metaphysical Foundations*, where Kant tries to spell out various metaphysical propositions relevant to the mathematical physicists of his day on the basis of what he has already shown to hold in the *Critique of Pure Reason*. We might even say

that whereas the *Critique* investigated the possibility of metaphysics in general, the *Metaphysical Foundations* goes about investigating an actual metaphysics in line with those critical possibilities. But we saw how the proposed actual metaphysics faces a number of debilitating interpretational and conceptual problems, most importantly among them were Kant's references to the actions of the transcendental imagination as providing some mathematics-inspired methodological handle on the whole task. Some of Kant's problems, I argued, could be alleviated (even if not ultimately solved) by re-thinking his transcendental principle called the Anticipations of Perception, which talks about the a priori ascription of magnitudes to objects of sensation. That is, it seemed that a more composite approach through some rational-physical elements taken together with the import of the said principle could help out here.

This revised approach, which would basically want to situate the phoronomical account of matter amidst the system of transcendental principles, was briefly delineated through a series of conjectures. Three results in particular would follow from this: 1) this will make a more plausible case for why motion is necessary for perceiving outer objects becaues the phoronomical account will belong among principles necessary for experience itself; 2) matter and motion will be inseparable designations of the outer object as such because matter is only a logical subject of motion in this account; 3) the actual spatial extent of matter, which is treated of by Kant's dynamical account, will have to belong together with the phoronomical account to the transcendental theory of experience so far as this theory spells out formal conditions of the constitution of appearances as extensive magnitudes. Now, these are only rough conjectures amongst others (including the negative option of simply rejecting everything said so far) and neither Kant nor I went

about justifying them or testing their consistency systematically. Instead, I tested their plausibility indirectly by taking them to Hegel's door to see if and how his remarks on relevant themes give them a more stable form. It turns out that not only does Hegel make similar points as those raised above but also fashions his own philosophy in ways that directly respond to them, and accordingly, I suggested that we can even glimpse in the Hegelian 'derivation' of natural categories based in space (and time) a massively refurbished Kantian 'construction.'

Texts culled from the logical, physiological, and psychological parts of his philosophical system (to speak somewhat inexactly) allowed us to consider Hegel's response in detail. In the first, Hegel's remarks in the *Science of Logic* interrogate Kant's construction-based method in the *Metaphysical Foundations* and I showed how his criticisms are not only well taken but also how Hegel's own account of the "ontological realization" of logical categories can be read as a revised and vastly expanded notion of construction. In the second, Hegel's remarks in the *Philosophy of Nature* outline a theory of matter that shows how motion belongs inseparably to it and I emphasized how this is grounded in a formal account of space and time without recourse to any talk of the transcendental imagination. In the third, Hegel's remarks in the *Philosophy of Mind* indicate some ways in which the knowledge of outer things in general draws upon that formal-dialectical account and here my specific interest was to see how the conceptualizations of space and time inform the manner of uptake of intuition in Hegel's theory of the production of representation and meaning. In sum, this lends shape and support to the set of conjectures opened by my analysis, even as I try to be careful about the principal differences between Kantian and Hegelian philosophies (which mainly turn

upon the reality or ideality of space and time and the nature or structure of self-consciousness).

I can close with some remarks contextualizing these results in terms of directions for research. One obvious way from here onwards leads to Kant's later writings on these topics, the texts of the *Opus postumum*, to see how Kant's later matter theorizing impacts his transcendental theorizing in far reaching ways, and the task of understanding this would benefit from the preliminary analyses provided here. Another road forward leads deeper into Kantian psychology, about which it became increasingly evident that more work needs to be done, mainly on the topics of *empirical investigation*, *sensation*, and *psychologism*.

I believe that a stress on the nature and prospects of empirical reasoning is a key characteristic of Kant's *Critique of the Power of Judgment*. Much work has already been done on that front by Allison, Ginsborg, Guyer, and Longuenesse, to name just a few who have explored its potential for developing accounts of concept acquisition and belief- and theory-formation in light of current epistemological debates. Much more work can be done along these lines by seeing how the particular failures of the *Metaphysical Foundations* with respect to a priori specifications of an empirical concept both situate those accounts and are resettled by them.

Also, various texts from the 3rd *Critique* indicate how Kant's account of sensation and related syntheses of the imagination may be investigated further, especially in light of the importance of this topic that was found to inform Kant's thought in the critical period and in light of Hegelian reworkings of the same. Kenneth Westphal and sometimes Longuenesse have indicated the relevance of this line of thinking to present-day

epistemological work influenced by cognitive-psychology and Modern Philosophy scholarship has similarly underlined the contemporary relevance of the nuances explored in that wider historical context. The dissertation, so far as it initiates central discussions about Kantian resources for understanding the structure and role of sensation in perception and theory, pushes into these broader concerns as well.

Finally, we encountered the ever present worry about Kantian psychologism that also occupied Hegel and Husserl, thinkers deeply sympathetic to the Kantian project. I feel that an elaboration of some of the specifics of this confrontation are necessary, especially in light of a sort of resurgence of Neo-Kantianism that is taking place and especially in light of the anti-psychologisms inaugurated by Hegel and Husserl themselves. This is too large a domain to fairly comment upon here – covering everything from certain trends in the philosophy of mind and naturalized phenomenology to Stephen Crowell's recent championing of a Laskian approach to long overdue recent interest in Husserl's second Logical Investigation, etc. - so I leave it as a fuzzy suggestion, merely marking the importance of these issues to Kant's alleged psychologism, which becomes prominent in dealing with the topics mentioned so far.

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