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**The *Prolegomena*  
and Natural Science**

Natural science is a central object of consideration in the *Prolegomena*. Sections 14 –39 are devoted to the Second Part of The Main Transcendental Question: "*How is pure natural science possible?*" These sections play a pivotal role in the book, corresponding to the Transcendental Analytic in the *Critique of Pure Reason*, and they include Kant's famous "answer to Hume" concerning the necessary connection between cause and effect (§§ 27-30). Moreover, the concluding three sections – prior to the appendix on the system of categories (§ 39) – address the question (§ 36, 318): "How is nature possible in the *formal* sense, as the sum total of the rules to which all appearances must be subject if they are thought as connected in one experience?" Kant proceeds to illustrate his answer to this question by "an example, which is supposed to show that laws which we discover in objects of sensory intuition, especially if these laws have been cognized as necessary, are already held by us to be such as have been put there by the understanding, although they are otherwise in all respects like the laws of nature that we attribute to experience" (§ 37, 320). And the example of such a law that Kant considers here is none other than the *Newtonian* law of universal gravitation (§ 38, 321): "a physical law of reciprocal attraction, extending to all material nature, the rule of which is that these attrac-

tions decrease inversely with the square of the distance from each point of attraction."

One might easily get the impression, therefore, that specifically *Newtonian* natural science is of particular importance in Kant's answer to the Second Part of The Main Transcendental Question. One might suppose, in particular, that *Newton's* derivation of the law of universal gravitation in Book 3 of the *Principia* provides Kant with a central example of how empirical causal connections (here those effected by gravitational force) can become necessary in Kant's sense, thereby contributing to his "answer to Hume." One might even suppose, finally, that this same example must be relevant to Kant's discussion of the "necessary lawfulness" of nature – "as *natura formaliter spectata*" – in the Transcendental Deduction of the *Critique of Pure Reason* (second edition; B165), since the latter discussion corresponds to that in §§ 36-38 of the *Prolegomena*. I believe that this impression, and these suppositions, are correct, but I first want to observe that important twentieth-century commentators have taken a quite different point of view.

It is striking, to begin with, that Dieter Henrich, in his classic paper on the second edition Transcendental Deduction, is explicitly opposed to interpreting this argument in light of Kant's commitment to *Newtonian* natural science. In considering an earlier sketch towards a revision of the Deduction in a long note to the Preface of the *Metaphysical Foundations of Natural Science* (474-476), Henrich explains why this sketch cannot satisfy the stricter demands addressed by the second edition Deduction (1968/1982, p. 75): "[Kant] has to *proceed* at this point *from the assumption* that we are in possession of synthetic *a priori* judgments concerning all objects of sensibility and that these judgments stand beyond all doubt in virtue of their employment in mathematical natural science. But this was the very presupposition which Hume called into question. And it is Kant's merit [in the second edition Deduction] to

have answered the radicalism of Hume's assault with a correspondingly radical founding of knowledge." In a footnote to this passage Henrich makes it clear that his criticism of the note to the Preface of the *Metaphysical Foundations* extends equally to the *Prolegomena* (1968/1982, p. 81, n. 12): "Like the *Prolegomena* [the note] starts from science as an indubitable fact, which is, according to the *Prolegomena*, legitimate only within an introduction into the Critique. The differences between the *Prolegomena* and the note may be ignored here."<sup>1</sup>

It is even more striking, however, that Gerd Buchdahl, who has especially emphasized the importance of natural science in Kant's overall critical project, takes a similar skeptical approach to the relevance of the *Prolegomena* – along with the *Metaphysical Foundations* – for understanding the central argument of the Transcendental Analytic. In his *Metaphysics and the Philosophy of Science* Buchdahl draws a sharp contrast between "experience" and "systematic experience," "nature" and "the order of nature." Experience or nature results from the constitutive activities of the understanding, whereas systematic experience or the order of nature results from the (merely) regulative demands of

<sup>1</sup> It seems clear that Henrich is here opposing the interpretation of the Marburg School of neo-Kantianism – as represented by Cohen (1871) and Cassirer (1907), for example – which understands Kant's "transcendental method" as proceeding from the "fact of science" and then seeking the necessary presuppositions of this "fact." According to the line of argument represented by Henrich, by contrast, the distinction Kant himself draws between the analytic method of the *Prolegomena* and the synthetic method of the *Critique* is supposed to show that the Marburg interpretation is appropriate only (at most) to the former work. For the relationship between the *Prolegomena* and the *Critique* in connection with analytic and synthetic methods see Paul Guyer's contribution to the present volume. It is worth noting that Henrich's treatment of the second edition Deduction is also opposed to the Marburg School in so far as one of his central goals is to preserve an independent contribution to this argument from the Transcendental Aesthetic – whereas, on the Marburg interpretation, Kant has definitively overcome the need for such an independent contribution in the second edition.

reason. Nature as constituted by the understanding consists of "a mere concatenated plurality" of spatio-temporal particulars, which is only subsequently transformed by the regulative employment of reason into an order of nature governed by systematic scientific laws.<sup>2</sup> It is only at the level of the order of nature that mathematical-physical theories such as *Newton's* come into play, and so Buchdahl requires that a "separation between science (as a body of laws) and the world of commonsense objects be made complete."<sup>3</sup> Experience as the object of the understanding is constituted entirely independently of all mathematical-physical theorizing, and thus comprises "the straightforward things of commonsense" bereft of all "scientifico-theoretical components."<sup>4</sup> Applying the category of causality within the realm of experience results only in particular events linked together in a completely contingent temporal sequence, and so Kant's suggestion in the *Prolegomena* that causal connections acquire necessity from the constitutive activities of the understanding – in the footnotes to §§ 20 (301) and 22 (305) – must be rejected as misleading.<sup>5</sup>

Yet it is *prima facie* odd to take the discussion in the *Prolegomena* – where Kant explicitly addresses Humean skeptical doubts concerning necessary connections in experience – to be misleading in precisely this respect. And, more generally, I believe that it is entirely inappropriate to rep-

<sup>2</sup> See Buchdahl (1969, pp. 480-481).

<sup>3</sup> See *op. cit.*, p. 659.

<sup>4</sup> See *op. cit.*, p. 638-639, n. 4.

<sup>5</sup> Buchdahl's view has an interesting relationship to the Marburg School as well, in so far as Buchdahl (like the Marburg School) places special emphasis on the regulative use of reason. However, whereas this emphasis, for the Marburg School, is intimately connected with its denial of an independent contribution by the faculty of sensibility (see note Fehler: Referenz nicht gefunden above), Buchdahl's sharp separation between the constitutive activities of the understanding and the merely regulative demands of reason points in a completely different direction. And, as a result, his conception of natural science as resting wholly on the contribution of reason *as opposed to* that of the understanding is also quite incompatible with the Marburg view.

resent the treatment of natural science in the *Prolegomena* (together with that of the *Metaphysical Foundations*) as incidental to the main argument of the Transcendental Analytic. I believe, on the contrary, that one can only fully understand Kant's evolving treatment of the central topics of the Analytic from the first to the second edition of the *Critique* by taking the intervening appearance of the *Prolegomena* (and the *Metaphysical Foundations*) very seriously indeed.

As is well known, the appearance of the first edition of the *Critique* (1781) was followed by a highly critical review by Garve and Feder (1782) claiming that what Kant had produced was simply a new version of an old doctrine – a version of psychological or subjective *Berkeleyan* idealism.<sup>6</sup> The Appendix to the *Prolegomena* (which appeared, of course, in 1783), *On What Can Be Done in Order to Make Metaphysics As Science Actual*, is almost exclusively devoted to a reply to this review. Kant attempts, in particular, conclusively to differentiate his view from *Berkeley's* by focussing on the critical doctrine of space (375): "I show, on the contrary, first: that space (and also time as well, to which *Berkeley* gave no attention), together with all its determinations, can be cognized by us *a priori*, since space (as well as time) inheres in us before all perception or experience as pure form of our sensibility and makes possible all intuitions from sensibility, and hence all appearances." Kant continues by asserting (*ibid.*) that his "so-called (properly, critical) idealism is thus of a wholly peculiar kind, namely, such that it overturns ordinary idealism, and such that by means of it all cognition *a priori*, even that of geometry, first acquires objective reality," and he therefore begs permission to call his philosophy "formal, or better, critical idealism, in order to distinguish it from the dogmatic idealism of *Berkeley* and the skeptical idealism of *Descartes*."

The extensive changes introduced into the second edition

<sup>6</sup> A translation of this review appears among the Background Source Materials appended to Kant (2004a, pp. 201-207).

of the *Critique* (1787) are intended further to delimit Kant's view from "ordinary" idealism (in both its *Berkeleyan* and Cartesian varieties) by emphasizing the importance of the representation of space (and thus geometry) in the critical system – so that Kantian "appearances," in particular, centrally include material bodies located outside us in space. This is especially true of the Refutation of Idealism, of course, which argues that even our knowledge of our own mental states in inner sense is itself only possible on the basis of our perception (our *immediate* perception) of external material bodies located in *outer* sense (B275): "[E]ven our *inner experience* (undoubted by *Descartes*) is only possible under the presupposition of outer experience."<sup>7</sup>

It is noteworthy, then, that the Preface to the *Metaphysical Foundations* (1786) contains its own version of a refutation of idealism. In principle, Kant says, there are two different species of "*special* metaphysical natural science (physics or psychology), in which the above transcendental principles [of the *Critique*] are applied to the two species of objects [outer and inner] of our senses" (470). It turns, out, however, that only the special metaphysics of *corporeal* nature can serve to ground a genuine science, because "in any special doctrine of nature there can be only as much *proper* science as there is *mathematics* therein" (ibid.). In particular, chemistry (unlike mathematical physics) will "only with great difficulty" every become a proper science (470-471), and the situation is even worse, Kant adds, in psychology (471): "Yet the empirical doctrine of the soul must remain even further from the rank of a properly so-called natural science than chemistry. In the first place, because mathematics is not applicable to the phenomena of inner sense and their laws, the only option one would have would be to

<sup>7</sup> The first Note to the following Proof emphasizes that "outer experience is really immediate\*" (B276) and then adds in the footnote (ibid.): "The immediate consciousness of the existence of outer things is not presupposed but proved in the preceding theorem, whether we have insight into the possibility of this consciousness or not."

take the *law of continuity* in the flux of inner changes into account – which, however, would be an extension of cognition standing to that which mathematics provides for the doctrine of body approximately as the doctrine of the properties of the straight line stand to the whole of geometry." Thus, since geometry cannot apply in any substantive way to the object of inner sense, there can be no proper science of this object (the soul) independent of our (more properly scientific) knowledge of the objects of outer sense.

A close connection between this argument and the Refutation of Idealism added to the second edition of the *Critique* emerges from an argument Kant provides in the General Note on the System of Principles (also added in the second edition) as confirmation of the Refutation of Idealism. Kant begins the Note by emphasizing the need for intuitions in connection with the objective reality of the categories (B288): "It is very remarkable that we cannot have insight into the possibility of things in accordance with the mere categories, but must always have available an intuition in order for it to display the objective reality of the pure concept of the understanding." He then goes further by emphasizing the need for specifically spatial intuitions (B291): "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*. If we take, e.g., the pure concepts of *relation*, we find that 1) in order to give something that persists in intuition, corresponding to the concept of *substance* (and thereby to verify the objective reality of this concept), we need an intuition *in space* (of matter), since space alone persistently determines, while time, however, and thus everything that is in inner sense, constantly flows." Kant concludes (B293-294): "This entire remark is of great importance, not only in order to confirm our preceding refutation of idealism, but, even more so, when we come to talk of *self-cognition* from mere inner consciousness and the determination of our na-

ture without the assistance of outer empirical intuitions, to indicate to us the limits of the possibility of such a cognition."<sup>8</sup>

Finally, there is an important passage towards the end of the Preface to the *Metaphysical Foundations* of which this discussion in the General Note is a clear echo. After carefully distinguishing between the general metaphysics (of the first Critique) and the special metaphysics of (*corporeal*) nature, Kant continues (478): "It is also indeed very remarkable (but cannot be expounded in detail here) 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 the principles of outer intuition; and, if these are not exhibited completely, it gropes uncertainly and unsteadily among mere meaningless concepts. . . . [here] the understanding is taught only by examples from corporeal nature what the conditions are under which such concepts can alone have objective reality, that is, meaning and truth." Where this point is "expounded in detail," it appears, is precisely the General Note added to the second edition of the Critique.

Following the appearance of the Garve-Feder review, therefore, Kant increasingly emphasizes the importance of space and material objects in space – and thus the importance of (pure) natural science – in the critical system. And he does this in a continuous development of thought that begins with the *Prolegomena*, continues through the *Metaphysical Foundations*, and culminates in the second edition of the Critique. So it is by no means surprising that Kant echoes the strategy of the *Prolegomena* in § VI of the Introduction to the second edition. He begins with "The general problem of pure reason" – "*How are synthetic judgments a priori possible?*" (B19), introduces Hume's skeptical doubts concerning the "synthetic proposition of the connection of

<sup>8</sup> Thus Kant intends his discussion here to point back to the Refutation of Idealism and also forward to the argument of the Paralogisms.



the effect with its cause" (ibid.), and then divides the general problem into two relatively unproblematic subproblems (B20): "*How is pure mathematics possible?*" and "*How is pure natural science possible?*" There can be no doubt concerning the possibility of these science, Kant suggests, "for that they must be possible is proved through their actuality" (ibid.). Kant continues (B20-21): "As far as *metaphysics* is concerned, however, its poor progress up to now, and the fact that of no metaphysics thus far expounded can it even be said that, as far as its essential end is concerned, it even really exists, leaves everyone with ground to doubt its possibility." What the *Prolegomena* identifies as the Third Part of the Main Transcendental Question – "*How is metaphysics in general possible?*" – must therefore be treated problematically.

Thus Kant is only prepared to take seriously skeptical doubts concerning the possibility of metaphysics, not concerning pure mathematics or pure natural science. Indeed, the skepticism Kant attributes to Hume here concerns precisely the possibility of metaphysics (B19-20): "David Hume, who among all philosophers came closest to [the general problem of pure reason], still did not conceive it anywhere near determinately enough and in its universality, but rather stopped with the synthetic proposition of the effect with its cause (*Principium causalitatis*), believing himself to have brought out that such an *a priori* proposition is entirely impossible, and according to his inferences everything that we call metaphysics would come down to a mere delusion of an alleged insight of reason into that which has in fact merely been borrowed from experience and from habit has taken on the appearance of necessity; an assertion, destructive of all pure philosophy, on which he would never have fallen if he had had our problem in its generality before his eyes, since he would have comprehended that according to his argument there could also be no pure mathematics, since this certainly contains synthetic *a priori* propositions, an assertion from which his sound understanding would surely

have protected him."

That Kant does not take seriously skeptical doubts concerning either pure mathematics or pure natural science is also clear in a passage added to the second edition of the preliminary remarks ("transition") to the Transcendental Deduction. Kant is here considering the attempts by Locke and Hume to derive (as Kant sees it) the pure categories of the understanding from experience. In the case of Hume (B127): "[S]ince he could not explain at all how it is possible for the understanding to think of concepts that in themselves are not combined in the understanding as still necessarily combined in the object, and it never occurred to him that perhaps the understanding itself, by means of these concepts, could be the originator of the experience in which its objects are encountered, he thus, driven by necessity, derived them from experience (namely from a subjective necessity arising from frequent association in experience, which is subsequently falsely held to be objective, i.e., custom)." Kant concludes (B127-128): "The *empirical* derivation, however, to which both of them [Locke and Hume] resorted, cannot be reconciled with the reality of the scientific cognition *a priori* that we possess, that namely of *pure mathematics* and *general natural science*, and is therefore refuted by the fact."

Just as in § VI of the (second edition) Introduction, therefore, Kant is here willing to take the actuality of pure mathematics and pure natural science as a clearly given fact. In the words of § VI (B20): "About these science, since they are actually given, it can appropriately be asked *how* they are possible; for that they must be possible is proved through their actuality.\*" To be sure, the footnote to this passage acknowledges (ibid.) that "[s]ome may still doubt this last point in the case of pure natural science." But Kant answers this doubt merely by pointing to propositions that he takes to be obviously synthetic *a priori* (ibid.): "Yet one need merely consider the various propositions that come forth at the outset of proper (empirical) physics, such as those of

the persistence of the same quantity of matter, of inertia, of the equality of action and reaction, etc., and one will be quickly convinced that they constitute a *physica pura* (or *rationalis*), which well deserves to be separately established, as a science of its own, in its whole extent, whether narrow or wide." (Translation from Kant (1997) slightly modified.) The three propositions Kant chooses to illustrate the unproblematic actuality of pure natural science here are the three Laws of Mechanics that he had meanwhile derived from the three Analogies of Experience in the third or Mechanics chapter of the *Metaphysical Foundations*.<sup>9</sup>

On the basis of these passages, I believe, two points are now clear. First, Kant does not, in the second edition Transcendental Deduction, take himself (as Henrich suggests) to be addressing a "radical" skeptical doubt concerning mathematical natural science. Secondly, although it may be true that the procedure of this Deduction is synthetic rather than analytic, in so far as it does not arrive at its premises by a regressive argument from the "fact" of mathematical natural science, it is nonetheless implausible to conclude (as both Henrich and Buchdahl suggest) that the intervening discussion of pure natural science in both the *Prolegomena* and the *Metaphysical Foundations* is (at best) incidental to the main argument of the Analytic.<sup>10</sup> I believe, on the contrary,

<sup>9</sup> These three Laws of Mechanics read as follows: "In all changes of corporeal nature the total quantity of matter remains the same, neither increased nor diminished" (541); "Every change of matter has an external cause. (Every body persists in its state of rest or motion, in the same direction, and with the same speed, if it is not compelled by an external cause to leave this state.)" (543); "In all communication of motion, action and reaction are always equal to one another" (544). Kant revised his statement of the three Analogies of Experience in the second edition of the Critique. The new statement of the first Analogy, in particular, clearly reflects the intervening appearance of the *Metaphysical Foundations* (B224): "In all change of appearances substance persists, and its quantum is neither increased nor diminished in nature."

<sup>10</sup> See again note Fehler: Referenz nicht gefunden above. It is worth noting, in this connection, that when Kant asserts in the preliminary

that we should use the discussions of natural science in the *Prolegomena* and the *Metaphysical Foundations* to illuminate the corresponding discussions in the *Analytic*. And since, as explained, we are actually faced with a continuous development of thought from the *Prolegomena* through the second edition of the *Critique*, we should use the corresponding discussions in all three of these works mutually to illuminate one another.

With these points in mind let us now turn to Kant's "answer to Hume" in the *Prolegomena* (§ 4, 312): "For having a try at Hume's problematic concept (this, his *crux metaphysicorum*), namely the concept of cause, there is first given to me *a priori*, by means of logic: the form of a conditional judgment in general, that is, the use of a given cognition as ground and another as consequent. It is, however, possible that in perception a rule of relation will be found, which says this: that a certain appearance is constantly followed by another (though not the reverse); and this is a case for me to use the hypothetical judgment and, e.g., to say: If a body is illuminated long enough by the sun, then it becomes warm. Here there is of course not yet a necessity of connection, hence not yet the concept of cause. But I continue on, and say: if the above proposition, which is merely a subjective connection of perceptions, is to be a proposition of experience, then it must be regarded as necessary

remarks to the second edition Deduction that the perspective on the pure concepts of the understanding common to both Locke and Hume is "refuted by the fact [*Faktum*]" of the actuality of pure mathematics and general natural science (B128), he uses the same word he used in the *Prolegomena* to characterize the distinctive synthetic procedure of the *Critique* in contrast to the analytic procedure he is now employing (274): "[The *Critique*] takes no foundation as given except reason itself, and [. . .] therefore tries to develop cognition out of its original seeds without relying on any fact [*Faktum*] whatsoever." And, although attempting to explain exactly what Kant means here lies well beyond the scope of this essay, I believe that the evidence is clear that he does not mean that the *Critique* aims at a "radical" reply to skepticism concerning the actuality of any synthetic *a priori* knowledge as such.

and universally valid. But a proposition of this sort would be: The sun is through its light the cause of the warmth. The foregoing empirical rule is now regarded as a law, and indeed as valid not merely of appearances, but of them on behalf of a possible experience, which requires universally and thus necessarily valid rules."<sup>11</sup>

Kant's discussion of this example begins considerably earlier in the *Prolegomena* in the course of his explanation of the distinction between judgments of perception and judgments of experience (§ 20, 301): "To have a more easily understood example, consider the following: If the sun shines on the stone it becomes warm. This judgment is a mere judgment of perception and contains no necessity, however often I and others also have perceived this; the perceptions are only usually found so combined. But if I

<sup>11</sup>For an extended discussion of Kant's "answer to Hume" see the contribution by Heiner Klemme in this volume. I shall here consider it primarily in relation to Kant's conception of pure natural science. In reference to the issue last raised in note Fehler: Referenz nicht gefunden above, it is clear that Kant does take seriously Hume's skepticism about the concept of causality and attempts to provide a principled reply – both in the *Prolegomena* and in the *Critique*. Yet it is also clear, from the passages quoted above in the Introduction (B19-21) and preliminary remarks to the Transcendental Deduction (B127-128), that taking seriously this form of skepticism is not the same, for Kant, as also taking seriously a much more radical skepticism concerning pure mathematics and pure natural science. For the former kind of skepticism is addressed to the actuality of "pure philosophy" or metaphysics (B20), not to that of pure mathematics and pure natural science. In this respect, I believe, Kant's view in the *Critique* (especially in the second edition) is precisely the same as that he expresses in discussing the General Question of the *Prolegomena*, *Is metaphysics possible at all?* (275): "Fortunately, it happens that, even though we cannot assume that metaphysics as science is *actual*, we can confidently say that some pure synthetic cognition *a priori* is actual and given, namely, *pure mathematics* and *pure natural science*; for both contain propositions that are fully acknowledged, some as apodictically certain through bare reason, some from universal agreement with experience (though these are still recognized as independent of experience). We have therefore some at least *uncontested* synthetic cognition *a priori*, and we do not need to ask whether it is possible (for it is actual), but only: *how it is possible*."

say: the sun *warms* the stone, then beyond the perception is added the understanding's concept of cause, which connects *necessarily* the concept of sunshine with that of heat, and the synthetic judgment becomes necessarily universally valid, hence objective, and changes from a perception into experience."<sup>12</sup> This distinction between two kinds of judgments, one subjective and the other objective, has appeared to many commentators to be problematic and, in particular, to be dropped in the second edition of the *Critique* in favor of the view that all judgments, as such, must be objective.<sup>12</sup> Nevertheless, the formulation of the general principle of the (three) Analogies of Experience employed in the second edition (together with the following additional paragraph labeled "Proof") emphasizes a parallel (but less controversial) distinction between perception and experience (B218): "*Experience is possible only through the representation of a necessary connection of perceptions.*"

But what is most problematic in Kant's "answer to Hume" is the suggestion that all experience, even that which is in itself entirely a posteriori and contingent, must nevertheless involve some kind of necessary connection. What does it mean, in particular, for a merely contingent sequence of perceptions (heat customarily following illumination by the sun) somehow to become necessary? In the *Prolegomena* Kant emphasizes what is problematic here in a footnote continuing the discussion of his example from § 20 (§ 22, 305): "But how does this proposition: that judgments of experience are supposed to contain necessity in the synthesis of perceptions, square with my proposition, urged many times above: that experience, as a posteriori cognition, can yield only contingent judgments?" It is precisely this problem, as I observed, that led Buchdahl to consider the discussion in the *Prolegomena* to be misleading and to insist, on the contrary, that experience as constituted by the

<sup>12</sup>This view is represented in the present volume by the contributions of Paul Guyer and Konstantin Pollok, a contrary view by that of Michael Wolff.

understanding contains no such (causal) necessity. Such necessity is only subsequently added by the faculty of reason in its search for systematic scientific laws, which are articulated precisely to explain the merely contingent sequences of particular events constituted by the understanding.

The most important point Buchdahl is missing, I believe, is the circumstance that the necessity in question is characterized in Kant's official discussion of the category of necessity in the Postulates of Empirical Thought – the three principles corresponding to the categories of possibility, actuality, and necessity (A218/B265-266): "1. Whatever agrees with the formal conditions of experience (in accordance with intuition and concepts) is *possible*. 2. That which is connected with the material conditions of experience (of sensation) is *actual*. 3. That whose connection with the actual is determined in accordance with general conditions of experience is (exists) *necessarily*." The "formal [or "general"] conditions of experience" include the forms of intuition (space and time), together with all the categories and principles of the understanding. And the "material" conditions of experience include that which is given to us, through sensation, in perception. Kant is thus describing a three-stage procedure in which we begin with the formal *a priori* conditions of the *possibility* of experience in general, perceive various *actual* events and processes by means of sensation, and then assemble these events and processes together in a unified experience via *necessary* connections using the general conditions of the possibility of experience with which we began.

In his detailed discussion of the third Postulate Kant makes it clear that he is referring, more specifically, to *causal* necessity and to particular (empirical) *causal laws* (A226-227/B279-280): "Finally, as far as the third postulate is concerned, it pertains to material necessity in existence, and not the merely formal and logical necessity in the connection of concepts. Now since no existence of objects of the senses can be cognized fully *a priori*, but always only compara-

tively *a priori* relative to another already given existence, but since nevertheless even then we can only arrive at an existence that must be contained somewhere in the nexus of experience of which the given perception is a part, the necessity of existence can thus never be cognized from concepts but rather always only from the connection with that which is perceived, in accordance with general laws of experience. Now there is no existence that could be cognized as necessary under the condition of other given appearances except the existence of effects from given causes in accordance with laws of causality. Thus, it is not the existence of things (substances) but of their state of which alone we can cognize their necessity, and moreover only from other states, which are given in perception, in accordance with empirical laws of causality."<sup>13</sup> Kant is suggesting, therefore, that the necessity in question is precisely that of the causal connections among diverse events whose (objective) necessity Hume had denied.

Read against the background of the explicit discussion of Hume's skeptical doubts in the *Prolegomena*, Kant is also suggesting that the empirical regularities in question are themselves transformed from mere "empirical rules" to genuine "necessary and universally valid" laws by the same procedure.<sup>14</sup> Thus in the example from § 29 of the *Prole-*

<sup>13</sup>Note that Kant mentions two essentially different types of laws in this passage: "general laws of experience" (such as the Analogies of Experience) and "empirical laws of causality" (i.e., particular causal laws relating particular kinds of events). Indeed, the very concept of causality with which Kant is operating demands such a universal empirical law in each case (A144/B183; emphasis added): "The schema of the cause and of the causality of a thing in general is the real upon which, whenever it is posited, something else *always* follows."

<sup>14</sup>Kant is simply equating necessity and universal validity here. He does the same in his treatment of causality in the Second Analogy (A200/B246; emphasis added): "in what precedes, the condition is to be encountered under which the occurrence always (i.e., *necessarily*) follows." Compare also the earlier characterization prior to the Transcendental Deduction (A91/B124): "For this concept [of causality] always requires that something A be such that something else B



*gomena* Kant begins from a mere "empirical rule" (that heat always follows illumination by the sun) and proceeds to a "necessary and universally valid" law by adding the *a priori* concept of cause to this (so far) merely inductive rule. The three-stage procedure described by the Postulates of Empirical Thought – in which we begin with the formal *a priori* conditions of the *possibility* of experience in general, perceive various *actual* events and processes by means of sensation, and then assemble these events and processes together in a unified experience via *necessary* connections using the general conditions of the possibility of experience with which we began – also results in a "necessary and universally valid" empirical causal law of nature (the sun is through its light the cause of heat) governing the events and processes in question.

To be sure, Kant does not make clear exactly how the law that the sun is through its light the cause of heat becomes "necessary and universally valid." He does not make clear exactly how this law acquires a more than merely inductive universality. A clearer case, however, is provided by the *Newtonian* law of universal gravitation that Kant considers in § 38 of the *Prolegomena*, where it is put forward, as noted at the beginning, as "an example, which is supposed to show that laws which we discover in objects of sensory intuition, especially if these laws have been cognized as necessary, are already held by us to be such as have been put there by the understanding, although they are otherwise in all respects like the laws of nature that we attribute to experience" (§ 37, 320). To see, moreover, exactly how this example illustrates the way in which an empirical law can in fact become "necessary and universally valid," we

follows from it *necessarily and in accordance with an absolutely universal rule.*" For an extended discussion of the relationship between the *a priori* principle of causality formulated in the Second Analogy and the particular empirical causal laws involved in all particular instances of the causal relation see Friedman (1992a), which also discusses this relationship in the context of the Postulates of Empirical Thought.

need also to consider Kant's discussion in the *Metaphysical Foundations* – where the fourth chapter or Phenomenology corresponds to the Postulates of Empirical Thought. And the role of this chapter, in particular, is to explain how attributions of motion and rest to matter can be successively determined under the modal categories as possibility, actuality, and necessity – thereby resulting in a distinction between "true" and merely "apparent" motion.

Kant, on my reading, here develops a reconstruction of *Newton's* "deduction from the phenomena" of the law of universal gravitation in Book 3 of the *Principia*.<sup>15</sup> We begin, following *Newton*, from the observable "Phenomena" described by *Kepler's* rules: the merely relative motions of the satellites in the solar system with respect to their primary bodies (the moon relative to the earth, the moons of Jupiter and Saturn relative to the planets in question, and the planets relative to the sun). We have not yet introduced a distinction between "true" and "apparent" motion, however, and so these Phenomena, are so far mere "appearances [*Erscheinungen*]" that have not yet attained the status of "experience [*Erfahrung*]" (554-555). The corresponding merely relative motions thus count as (so far) merely *possible*.<sup>16</sup> At the next stage (again following *Newton*) we then use the law of inertia (Kant's second Law of Mechanics) to derive inverse-square (centripetal) accelerations of their satellites directed towards every primary body in the solar system (the moon towards the earth, the moons of Jupiter and Saturn towards their primary bodies, and so on): we now have "true" (as opposed to merely "ap-

<sup>15</sup>For this reading of the Phenomenology (also in the context of the Postulates of Empirical Thought) see again Friedman (1992a).

<sup>16</sup>For example, Phenomenon 4 at the beginning of Book 3 of the *Principia* states that either the earth revolves around the sun in accordance with *Kepler's* 3/2 power rule or the sun revolves around the earth in accordance with the same rule. *Newton* thus leaves it entirely open, at this point, whether the earth or the sun is the "true" center of the (so far) merely relative motion in question. So both descriptions, from Kant's point of view, are at this point (merely) *possible*.

parent") orbital rotations in each case, which hence now count as *actual*.<sup>17</sup> At the third stage, finally, we show (once again following *Newton*) both that the accelerations in question are directly proportional to the quantities of matter of the corresponding primary bodies (so that the acceleration of the moon is proportional to the earth's mass, those of the moons of Jupiter and Saturn are proportional to the masses of their primary bodies, and so on) and that such accelerations are also everywhere mutual between any two gravitationally interacting bodies (so that the earth accelerates towards the moon in turn, Jupiter and Saturn towards their satellites, and so on). Here, in accordance with the equality of action and reaction (Kant's third Law of Mechanics), we now have what Kant calls *necessary* equal and opposite motions, where the accelerations of any two gravitationally interacting bodies are oppositely directed and in inverse proportion to their masses.<sup>18</sup>

In thus determining all the motions in question as first possible, then actual, and finally necessary we have, by the same argument, also established the law of universal gravitation: each body experiences a gravitational acceleration

<sup>17</sup>In the case of the earth-sun system, in particular, we now know that the two bodies *actually* rotate yearly around a common center of gravity – as opposed to a "true" yearly rotation of the fixed stars in the contrary direction. We do not yet know, however, exactly where this common center of gravity (and thus the "true" center of motion) really lies.

<sup>18</sup>Continuing the example of the earth-sun system, then, we now have *necessary* inverse-square accelerations of both the earth towards the sun and the sun towards the earth, where each of these accelerations is directly proportional to the mass of the body towards which it is directed. By comparing the acceleration of the moon towards the earth and of Venus towards the sun, however, it follows that the mass of the sun is much, much greater than that of the earth, and so the center of gravity of the earth-sun system is in fact extremely close to the center of the sun. More generally, the center of gravity of the entire solar system is also very close to the center of the sun, and so it turns out that the sun is (to a high degree of approximation) the "true" center of motion of all the accelerations (and associated orbital rotations) in the solar system resulting from the corresponding gravitational interactions.

towards every other body that is directly proportional to the mass of the body towards which it accelerates and inversely proportional to the square of the distance between them.<sup>19</sup> And, since each of these mutual accelerations has just been determined as necessary in accordance with the Postulates of Empirical Thought, the law of universal gravitation has itself been determined as (conditionally) necessary in the same sense – relative, that is, to the initial Keplerian "Phenomena" from which we begin. The law of universal gravitation, in other words, is determined in its connection with the actual in accordance with the general conditions of the possibility of experience: namely, the three Analogies of Experience as further specified by Kant's three Laws of Mechanics. The point is that, whereas *Kepler's* rules are (so far) merely inductive generalizations and, as such, are not yet grounded in *a priori* laws of the understanding, the law of universal gravitation is obtained by applying such *a priori* laws to these Keplerian rules. And, in precisely this way, the law of universal gravitation itself acquires a more than inductive "material necessity."<sup>20</sup> Kant's reconstruction of *Newton's* "deduction" of the law of universal gravitation from the initial Keplerian "Phenomena" thereby provides a perfect illustration of the three-step procedure suggested in the Postulates of Empirical Thought whereby a mere "em-

<sup>19</sup>There are gravitational *forces* between any two such bodies that are directly proportional to the *product* of their (two) masses. By *Newton's* Second Law of Motion, however, the force on any one such body is directly proportional to the product of its acceleration and its mass. Hence, in virtue of the equality of gravitational and inertial mass, the acceleration of any one such body is directly proportional to the mass of the second body alone.

<sup>20</sup>*Kepler's* rules also acquire their own "material necessity" by the same process in so far as they are now viewed as *approximations* to the "true" motions described by the law of universal gravitation. The latter, in particular, entails *perturbations* from ideal Keplerian orbital motion due to the (relatively small) gravitational accelerations of the satellites of the primary bodies in the solar system produced by gravitational interactions with bodies other than the primary bodies in question (as Jupiter and Saturn, for example, experience attractions from one another in addition to their attractions by the sun).

pirical rule" is transformed into a "necessary and universally valid" objective law.<sup>21</sup>

Thus, by connecting Kant's "answer to Hume" in §§ 27-30 of the *Prolegomena* with the Postulates of Empirical Thought in the first Critique, and by connecting Kant's illustration of how empirical laws become necessary in §§ 36-38 of the *Prolegomena* with the Phenomenology of the *Metaphysical Foundations*, it is possible to attain a good understanding of the sense in which the *Newtonian* law of universal gravitation, for Kant, is paradigmatic of the process of successive determination by which empirical causal laws can become necessary. Indeed, Kant's discussion of the law of universal gravitation in § 38 of the *Prolegomena* provides strong confirmation that *Newton's* "deduction" of this law from the initial Keplerian "Phenomena" is precisely what Kant has in mind. For Kant begins his discussion with a fundamental property of circles established in Book III of Euclid's *Elements* (320), from which Huygens first derived what we now take to be the correct formula for centripetal (or centrifugal) acceleration in uniform circular motion.<sup>22</sup> *Newton* then generalized this reasoning to

<sup>21</sup>In an unpublished *Reflexion*, written between the late 1770s and mid 1780s, Kant illustrates the transformation in question by precisely the transition from *Kepler* to *Newton* (R 5414; 18, 176): "One can very well bring forth rules empirically, but not laws, as *Kepler* did in comparison with *Newton*; for to the latter there belongs necessity, hence that they are cognized *a priori*." (Translation from Kant (2005) slightly modified.) Kant alludes to the same transformation in his introductory remarks to the *Idea for a Universal History with a Cosmopolitan Aim* of 1784 (8, 18): "Thus [nature] did produce a *Kepler*, who subjected the eccentric orbits of the planets in an unexpected way to determinate laws, and a *Newton* who explained these laws from a universal natural cause." (Translation from Kant (2007) slightly modified.) I am indebted to Konstantin Pollok for this last citation.

<sup>22</sup>Kant states Euclid III.35: if two lines intersect within a circle at point E, and meet the circle at A, C and B, D respectively, then  $AE \times EC = BE \times ED$ . But this property is easily extended to points outside the circle as well – yielding, in particular, Euclid III.36 when one of the lines is tangent to the circle. And it is from this latter property

motion in conic sections in accordance with *Kepler's* area rule to derive the inverse-square law for centripetal acceleration in all such cases. It is by no means surprising, therefore, that Kant next refers to the natural generalization of the relevant Propositions of Euclid to conic sections (321) – which, in turn, is just the formula to which *Newton* appeals in first deriving the inverse-square law for Keplerian motion.<sup>23</sup> And, since Kant's example of the inverse-square "physical law of reciprocal attraction" immediately follows (*ibid.*), there can be very little doubt that he is alluding to precisely the *Newtonian* "deduction from the phenomena" here. Kant's discussion of the law of universal gravitation in the *Prolegomena* is therefore completely consistent with the account he will soon develop, three years later, in the *Phenomenology of the Metaphysical Foundations*.<sup>24</sup>

that Huygens (and, independently, *Newton*) derived the law of centripetal (and centrifugal) acceleration. For a detailed exposition see Brackenridge (1995, pp. 58-63).

<sup>23</sup>Kant states a corresponding general property for conic sections well known from Apollonius's *Conics*: suppose that the members of two given pairs of straight lines intersect one another at E, E' respectively and meet the conic at A, C and B, D and at A', C' and B', D' respectively; then, if the lines AC, A'C' and BD, B'D' are respectively parallel to one another,  $(AE \times EC)/(BE \times ED) = (A'E' \times E'C')/(B'E' \times E'D')$ . We again have a special case when two of the lines are conjugate diameters and one of the lines parallel to such a diameter is an ordinate of the other diameter, and it is from this latter property that *Newton* derives the inverse-square law for Keplerian motion in conic sections in Proposition 10-13 of Book 1 of the *Principia*. For a detailed exposition see Brackenridge (1995, pp. 102-118).

<sup>24</sup>For a detailed discussion of the transition in § 38 from the circle through the *Conics* to the law of universal gravitation see Friedman (1992b, Chapter 4) – although I do not there point out the connection with Huygens's treatment of centripetal/centrifugal acceleration. Kant explicitly emphasizes the transition from *Kepler* through Huygens to *Newton* in the *Opus postumum* (22, 528-529): "The laws of [orbital] motion were sufficiently established by *Kepler's* three analogies. . . . Huygens knew also of composite yet derivative motion, through forces fleeing the midpoint or constantly driving toward it (*vis centrifuga et centripeta*). But no matter how close they both [came] . . . all that which had been achieved remained empiricism in the doctrine of motion, and there was as yet no universal principle properly so-called,

Kant does not explicitly discuss the law of universal gravitation in the (second edition) Transcendental Deduction of the Critique – where, as I observed at the beginning, there is a discussion of the “necessary lawfulness” of nature corresponds to §§ 36-38 of the *Prolegomena*. Nevertheless, the proposition that bodies are heavy plays a crucial role in § 19 of the second edition Deduction that is well worth considering here. This proposition functions as a central example of a synthetic (as opposed to analytic) judgment in the Introduction to the *Critique* in both editions (A7-8/B11-12). In § 19 of the second edition, however, it functions as a central example of a judgment in general and of the way, in particular, in which all judgments as such are objectively determined by the transcendental unity of apperception. Kant begins by famously defining a judgment in general as “nothing other than the way to bring given cognitions to the *objective* unity of apperception” (B140). He then continues (B141-142): “That is the aim of the copula *is* in them: to distinguish the objective unity of given representations from the subjective. For this word designates the relation of representations to original apperception and its *necessary unity*, even if the judgment itself is empirical, hence contingent, e.g., Bodies are heavy. By that, to be sure, I do not mean to say that these representations *necessarily* belong to one another in the empirical intuition, but rather that they belong to one another *in virtue of the necessary unity* of the apperception in the synthesis of intuitions, i.e., in accordance with principles of the objective determination of all representations insofar as cognition can come from them, which principles are all derived from the transcendental unity of apperception.”

This discussion, in the present context, is of particular interest for at least two reasons. First, it is central to the

that is, a concept of reason, from which it would have been possible to infer *a priori* to a law for the determination of forces, as from a cause to its effect, and this solution was given by *Newton . . .*” (Translation from Kant (1993) slightly modified.)

question of the relationship between the distinction between judgments of perception and judgments of experience in the *Prolegomena* and the conception of objective judgment represented in the second edition of the Critique. Indeed the above passage from the latter discussion continues as follows (B142): "Only in this way does there arise from this relation a *judgment*, i.e., a relation that is *objectively valid*, and that is sufficiently distinguished from the relation of these same representations in which there would be only subjective validity, e.g., in accordance with laws of association. In accordance with the latter I could only say 'If I support a body, I feel a pressure of weight,' but not 'It, the body is heavy,' which would be to say that the two representations are combined in the object, i.e., regardless of any difference in the condition of the subject, and are not merely found together in perception (however often as that might be repeated)." Here the connection with the *Prolegomena*'s distinction between judgments of perception and judgments of experience is especially obvious, as well as the connection with the *Prolegomena*'s closely related "answer to Hume."

Secondly, the discussion of "Bodies are heavy" in § 19 of the second edition also plays a central role in Buchdahl's conception of the relationship between the *Prolegomena* and the first Critique – according to which, in the latter, Kant is finally completely explicit that there cannot be necessary connections between merely contingently related representations in experience as constituted by the understanding. As Buchdahl himself puts it (1969, p. 637): "In short, at the level of empirical consciousness, i.e. empirical contingent reality, there is no necessity. The necessary unity of apperception does not yield necessary connections at the empirical level." Indeed, as explained, Buchdahl believes that such necessary connections in "empirical contingent reality" cannot be constituted by the understanding at all, but only by the regulative use of reason in its application to particular causal laws of empirical natural science.<sup>25</sup>

<sup>25</sup>The relationship between the present issue and my earlier discussion



When last considering Buchdahl's views on causal necessity I argued that the main point he is missing is the role of the category of necessity in the Postulates of Empirical Thought. The same point is relevant here in the more abstract context of the second edition Deduction. In the case of the (empirical and contingent) judgment that bodies are heavy Kant says (B142) that the two representations in question (the subject concept and the predicate concept) "belong to one another *in virtue of the necessary unity* of the apperception in the synthesis of intuitions, i.e., in accordance with principles of the objective determination of all representations insofar as cognition can come from them, which principles are all derived from the transcendental unity of apperception." Kant is describing, therefore, a procedure of "objective determination" under "principles" that takes its starting point from the transcendental unity of apperception – the very "highest" principle of the "unity of different concepts in judgments" (B131). And, if we take the "lower" principles of synthetic determination then "derived" from the unity of apperception to be none other than the principles of pure understanding, it appears that the three-stage procedure described in the Postulates of Empirical Thought occurs at the terminus of the more abstract procedure of synthetic determination described in § 19.

In his discussion of the general principle of the (three) Analogies of Experience Kant divides the principles of pure understanding into *mathematical* principles (Axioms of Intuitions and Anticipations of Perception) and *dynamical*

of Buchdahl's view becomes clear when we observe that the passage cited in note Fehler: Referenz nicht gefunden above occurs in a footnote towards the end of his consideration of § 19 of the second edition Deduction. The passage reads more fully as follows (1969, pp. 638-639, n. 4): "At the empirical level, the 'objects' of Kant's world are the straightforward things of commonsense, their grammar is not indebted to any scientifico-theoretical components. For the further conceptualization and incorporation into theoretical contexts, we have to move on to the level of 'reason', in its 'constructive' employment."

principles (Analogies of Experience and Postulates of Empirical Thought). Unlike the mathematical principles, Kant says, an Analogy of Experience "will not be valid of the objects (of the appearances) *constitutively* but merely *regulatively*" (A180/B222-223).<sup>26</sup> In addition (A180/B223): "The very same thing will also hold for the postulates of empirical thinking in general, which together concern the synthesis of mere intuition (of the form of appearance), or perception (of its matter), and of experience (of the relation of these perceptions)." Kant indicates, therefore, that the three Postulates of Empirical Thought correspond to the Axioms of Intuition, Anticipations of Perception, and Analogies of Experience respectively. So the three-stage procedure of synthetic determination in accordance with the categories of possibility, actuality, and necessity described in the Postulates occurs at the level of the principles of pure understanding, and, more specifically, it recapitulates the process of determining an objective judgment in accordance with the Axioms, Anticipations, and Analogies.

Section 19 suggests that we begin by proceeding from the synthetic unity of apperception in the Transcendental Deduction through the schemata of the individual categories in the Schematism chapter to the principles of pure understanding. When we reach this level, according to the Pos-

<sup>26</sup>Kant does not mean that the Analogies are merely regulative principles of *reason*, however, as he later explains at the end of the Appendix to the Dialectic on the regulative use of the ideas of pure reason (A664/B692): "In the Transcendental Analytic we have distinguished among the principles of the understanding the *dynamical* ones, as merely regulative principles of *intuition*, from the *mathematical* ones, which are constitutive in regard to intuition. Despite this, the dynamical laws we are thinking of are still constitutive with regard to *experience*, since they make possible *a priori* the *concepts* without which there is no experience. Principles of pure reason, on the contrary, cannot be constitutive even in regard to empirical *concepts*, because for them no corresponding schema of sensibility can be given, and therefore they can have no object *in concreto*." The relevant contrast, therefore, is between being constitutive with respect to perception or intuition and being constitutive with respect to experience. For an extended discussion see again Friedman (1992b, Chapter 4).

tulates, we first determine a putative objective judgment in terms of the categories of quantity, then in terms of the categories of quality, and finally in terms of the categories of relation. And the important point here is that the modal categories do not add any further predicates of objective synthetic determination beyond the determination of a given object as a magnitude, a reality, or a substance in causal relations with others. They instead correspond to the different successive stages, in accordance with the three previous sets of categories, of "the objective determination of all representations insofar as cognition can come from them" (B142), and they thereby indicate at exactly which stage we happen to be in this ongoing cognitive process.<sup>27</sup> The category of necessity, in particular, comes into play when "[t]hat which is connected with the material conditions of experience (of sensation)" is then further "determined in accordance with general conditions of experience" (A218/B266). And, since these two stages correspond, respectively, to the Anticipations of Perception and Analogies of Experience, an application of the category of necessity occurs precisely when a mere perception is then transformed into a genuine

<sup>27</sup>See the discussion at the beginning of the "elucidation" following the initial presentation of the three Postulates (A219/B266): "The categories of modality have this peculiarity: as a determination of the object they do not augment the concept to which they are ascribed in the least, but rather express only the relation to the faculty of cognition. If the concept of a thing is already entirely complete, I can still ask about this object whether it is merely possible, or also actual, or, if it is the latter, whether it is also necessary? No further determinations in the object itself are hereby thought; rather, it is only asked: how is the object itself (together with all its determinations) related to the understanding and its empirical use, to the empirical power of judgment, and to reason (in its application to experience)?" Compare the parallel discussion in the earlier section on the logical forms of judgment (A74/B99-100): "The modality of judgments is a quite special function of them, which is distinctive in that it contributes nothing to the content of the judgment (for besides quantity, quality, and relation there is nothing that constitutes the content of a judgment), but rather concerns only the value of the copula in relation to thinking in general."

experience.

I already observed that Kant reformulates the general principle of the (three) Analogies of Experience in the second edition of the *Critique*(B218): "*Experience is possible only through the representation of a necessary connection of perceptions.*" I also observed that this formulation appears to be closely related to (but less controversial than) the central distinction in the *Prolegomena* between judgments of perception and judgments of experience.<sup>28</sup> I am now in a position to add (contrary to Buchdahl) that the discussion of "Bodies are heavy" in § 19 of the second edition is perfectly consistent with the view represented in the *Prolegomena* that the necessary connections among diverse perceptions whose objective justification was denied by Hume are constitutive of the possibility of experience – and hence of the possibility of genuinely objective judgment. For, if we leave aside the controversial terminology of "judgments of perception," Kant appears to be saying the same thing in both places: genuinely objective judgments require the use of the Analogies of Experience and, for precisely this reason, involve necessary connections among perceptions. In particular, Kant is not denying in § 19 that the representations in question ultimately become necessarily connected in the procedure of objective determination he describes. He is saying merely that they are not given as necessarily connected "in the empirical intuition" (B142) – or, in other words, in perception. The only way in which such a necessary connection can possibly arise is from a further determination of these same representations in *experience*.

But how can the (empirical and contingent) judgment "Bodies are heavy [*die Körper sind schwer*]" possibly ex-

<sup>28</sup>See note Fehler: Referenz nicht gefunden above, together with the paragraph to which it is appended. Michael Wolff's contribution to the present volume suggests that what the *Prolegomena* calls "judgments of perception" can be conceived as those which, in the ongoing cognitive process, have reached the stage of the Anticipations of Perception but not yet that of the Analogies of Experience.

press a necessary connection? The answer is essentially the same here as in my earlier discussion of causal necessity and empirical laws of nature: namely, the necessity figuring in the Postulates of Empirical Thought is an empirical (or "material") necessity that is contingent upon already given perceptions.<sup>29</sup> And if, once again, we attend to the continuous development of thought from the *Prolegomena* through the *Metaphysical Foundations* to the second edition of the Critique, it appears that the law of universal gravitation is just as relevant in the later work as it is (explicitly) in the two earlier works. The *Metaphysical Foundations*, in particular, defines heaviness or "weight [*Schwere*]" as follows (517): "The action of the universal attraction immediately exerted by each matter on all matters, and at all distances, is called *gravitation* [*Gravitation*]; the tendency to move in the direction of greater gravitation is called *weight* [*Schwere*]." Kant's developed view of the phenomenon of heaviness or weight, therefore, is that the explanation of this phenomenon rests on the law of universal gravitation – according to which, in particular, heavy bodies fall to the earth precisely because (at least near the earth's surface) it is the overwhelmingly greatest source of gravitational attraction in their neighborhood. Heaviness or weight is thus a causal disposition of bodies: a tendency to fall to the earth when unsupported.<sup>30</sup> And the ultimate explanation of this

<sup>29</sup>For the notion of "material" necessity see again the passage from the Postulates (A226-227/B279-280) to which note Fehler: Referenz nicht gefunden above is appended. Kant there emphasizes that only the connections among states of substances can be necessary in this sense, where one state is known "comparatively *a priori*" conditional upon another given state. So the necessity in question should be sharply distinguished from that pertaining to synthetic *a priori* judgments of pure mathematics, pure natural science (such as Kant's three Laws of Mechanics), and transcendental philosophy (such as the Analogies of Experience). Nevertheless, distinctively "material" necessity, in accordance with the Postulates, is itself *conditionally* determined in virtue of precisely the *unconditional* necessity of these synthetic *a priori* judgments.

<sup>30</sup>See the discussion of the weaker (or "comparative") notion of a pri-

disposition – the law of universal gravitation – is itself (“materially”) necessary in accordance with the third Postulate. So it is in precisely this sense that the judgment that bodies are heavy can express an objective necessary connection between empirically given perceptions despite the fact that, as a judgment, it is still conditional upon (and thus contingent upon) these same perceptions.<sup>31</sup>

What is essential to Kant’s conception of objective judgment, therefore, is a procedure of synthetic determination that begins, at the highest level, by applying the transcendental unity of apperception to our pure forms of spatio-temporal intuition in the Transcendental Deduction. We

ority in § I of the second edition Introduction, which Kant again illustrates by the judgment that bodies are heavy (B2): “[I]t is customary to say of many a cognition derived from experiential sources that we are capable of it or partake in it *a priori*, because we do not derive it immediately from experience, but rather from a general rule that we have nevertheless borrowed from experience. So one says of someone who undermined the foundations of his house that he could have known *a priori* that it would collapse, i.e., he need not have waited for the experience of it actually collapsing. Yet he could not have known this entirely *a priori*. For that bodies are heavy and hence fall if their support is taken away must first have become known to him through experience.”

<sup>31</sup>Consider, in this context, the answer Kant gives to the problem of how necessary connections can be present in judgments of experience in the footnote to § 22 of the *Prolegomena* (305): “If I say: experience teaches me something, I always mean only the perception that is in it – e.g., that upon illumination of the stone by the sun, warmth always follows – and hence the proposition from experience is, so far, always contingent. That this warming follows necessarily from illumination by the sun is indeed contained in the judgment of experience (in virtue of the concept of cause), but I do not learn this from experience; rather, conversely, experience is first generated through this addition of a concept of the understanding (of cause) to the perception. Concerning how the perception may come by this addition, the *Critique* must be consulted, in the section on the transcendental power of judgment, pp. 137 ff.” The reference (A137 ff.) is at least to the Schematism chapter, or perhaps to the entire remainder – after the Introduction (“on the transcendental power of judgment in general”) – of the *Analytic of Principles*.

then move through the schemata of the individual categories to the principles of pure understanding corresponding to these categories. And at this level, in particular, we can distinguish three distinct steps or stages. We first consider "the formal conditions of experience (in accordance with intuition and concepts)" lying in wait for any sensations that may be given to us within these forms (as the matter of intuition) under the category of possibility (A218/B265). When we are next presented with "the material conditions of experience (of sensation)," we then have occasion to apply the category of actuality to the resulting perceptions (A218/B266). And when we are finally in a position (further) to determine what is actual "in accordance with general conditions of experience," we can now – and only now – apply the category of necessity (ibid.).

We thereby undertake an increasingly determinate progression of presumptive objective judgments during which we first record what is so far given to us merely in perception (when a body is illuminated long enough by the sun it becomes warm, unsupported bodies fall) and finally arrive at the most well-established laws of empirical natural science (such as the law of universal gravitation). And it is only at this last stage that we have in fact achieved a fully determinate and completely objective judgment in which perception has in fact been completely transformed into experience. Kant's conception of objective judgment – both in the *Prolegomena* and the Critique – is thus inextricably entangled with a serious consideration of the best example of empirical natural science of his time (the *Newtonian* theory of universal gravitation). Moreover, in accordance with the continuous development of thought from the *Prolegomena* through the *Metaphysical Foundations* to the second edition of the Critique, this exemplary empirical natural science is itself only possible in virtue of the pure natural science for which Kant himself provides a philosophical foundation in the *Transcendental Analytic*.<sup>32</sup>

<sup>32</sup>In thus emphasizing the central importance of Kant's conception of

An important question remains, however, concerning the status of ostensible judgments (when a body is illuminated long enough by the sun it becomes warm, unsupported bodies fall) when they have not yet been completely determined as objective. These are precisely what the *Prolegomena* calls "judgments of perception," of course, in contrast to judgments of experience. The question is not so much whether or not they still count as judgments at all – which, at this point, appears to be largely terminological. What is important (and also relatively uncontroversial) is that they represent a significant stage in the *process of objectification* (that corresponding to the category of actuality), and the most pressing question, from this point of view, is exactly how they can play their intended role in this process if they do not yet count as (fully) objective themselves.<sup>33</sup> How, in particular, can we possibly be justified in inferring a genuine judgment of experience from what the *Prolegomena* calls a "judgment of perception" if the latter is merely subjective? Or, to ask the same question more pointedly in the context of our paradigmatic example: Was there no gen-

natural science, not only for the *Prolegomena* but also for the Transcendental Deduction of the first Critique, I am thereby opposing the views of both Buchdahl and Henrich: see again notes Fehler: Referenz nicht gefunden and Fehler: Referenz nicht gefunden above, together with the paragraphs to which they are appended.

<sup>33</sup>Section 19 of the second edition indeed appears to suggest that all judgments, as such, are objective (B142): "Only in this way does there arise from this relation a judgment, i.e., a relation that is objectively valid, and that is sufficiently distinguished from the relation of these same representations in which there would be only subjective validity, e.g., in accordance with laws of association." I am suggesting here, however, that the question of what is required by a fully objective judgment is more pressing than the question whether we allow less than fully objective judgments to count as judgments at all. What is most important, in my view, is to understand the *process of objectification* by which ostensibly objective judgments *become* (fully) objective in the specific sequence of steps or stages described in the Postulates of Empirical Thought: compare note Fehler: Referenz nicht gefunden above, together with the paragraph to which it is appended and the preceding paragraph.



uinely objective experience before *Newton* established the law of universal gravitation in the *Principia*, and, if not, how could this law have ever been established empirically?

As we know, the actual empirical basis to which *Newton* appeals in establishing the law of universal gravitation consists of the Keplerian "Phenomena" initiating the argument of Book 3 of the *Principia*. So the statements of these same "Phenomena," in this context, are paradigmatic of what the *Prolegomena* calls "judgments of perception."<sup>34</sup> What is the status of these "Phenomena" before the argument of Book 3 has been formulated? The answer, I suggest, is that the observations (in Kantian terminology "perceptions") of the relative motions of the heavenly bodies in the solar system made before *Newton* finally explained them by means of the theory of universal gravitation need not actually be explicitly incorporated within this theory in order to count as objectively valid. What is required, rather, is only that they be capable of such incorporation, which first reveals exactly how they are rigorously and determinately situated with a unified – and unitary – objective world. The *Newtonian* incorporation of these phenomena within the theory of universal gravitation thus makes their objective grounding fully explicit, we might say, in the same way that Frege's formulation of quantificational logic in 1879 makes the logical validity of various mathematical arguments (involving, for example the concept of continuity) fully explicit. Just as such arguments were already logically valid before Frege first explicitly revealed the ultimate grounds of their logical validity, so pre-*Newtonian* phenomena may count as objectively valid in Kant's sense even before Kant himself, taking *Newtonian* natural science as his model, first explicitly revealed the ultimate grounds of their objective validity. Thus *Kepler's* rules do in fact count as objectively valid in this sense in so far as they are capable of being later incor-

<sup>34</sup>See again notes Fehler: Referenz nicht gefunden and Fehler: Referenz nicht gefunden above, together with the paragraphs to which they are appended.

porated within *Newton's* theory. And, more generally, what Kant calls "judgments of perception" in the *Prolegomena* also count as objectively valid in so far as they are capable of being transformed into judgments of experience.<sup>35</sup> For they then play precisely the role in the ongoing process of successive objectification for which they are intended – a process at the end of which they now represent explicitly the objective necessary connections among diverse given perceptions that were the target of Hume's skeptical doubts.

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<sup>35</sup>We have seen (note Fehler: Referenz nicht gefunden above) how *Kepler's* empirical rules in fact become objective laws in this procedure – where, at the same time, they are corrected and are now viewed as approximate. So we might reasonably suppose that what the *Prolegomena* calls "judgments of perception" may be corrected in the same way and thereby become more precise. Section 19 of the *Prolegomena* also considers a class of "judgments of perception," such as "the room is warm, the sugar sweet, the wormwood repugnant," that "refer merely to feeling – which everyone acknowledges to be merely subjective and which must therefore never be attributed to the object – and therefore can never become objective" (299). See Konstantin Pollok's contribution to the present volume for further discussion.

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