KANT'S COPERNICAN HYPOTHESIS: AN AFFIRMATION OF TRANSCENDENTAL IDEALISM AS A VIABLE FOUNDATION FOR THE SCIENCES AND EMPIRICAL REALISM

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by
Stanley Joseph Konoval
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Examining Committee Members:

Lara Ostaric, Advisory Chair, Philosophy
Eli Alshanetsky, Philosophy
Miriam Solomon, Philosophy
Colin McLear, University of Nebraska-Lincoln
Peter Marshall, External Reader, Cognition and Neuroscience

ABSTRACT

This dissertation focuses on questions in Kant's philosophy of science, specifically, how we might understand it in light of his transcendental idealism, and whether it has not just historical relevance, but also continuing relevance to contemporary developments in the sciences. The dissertation takes the following form. Chapter one seeks to demonstrate that one of Kant's primary aims in the first *Critique* was to respond to regional skepticism, that is, skepticism about the possibility of our acquiring knowledge of necessary truths in the specific regions of metaphysics and science. Chapter two argues that Kant advocated in the first *Critique* for "intellectualism," that is, the idea that the categories provide the form, or structure, for our mind's synthesis of our representations, and it is these same categories which ground necessity claims about the world as it appears us. Chapter three presents an interpretation of Kant's *Metaphysical Foundations of Natural Science* to serve as a model for a Kantian approach to other sciences by showing that, for Kant, proper science has an empirical component, but it is grounded on the *a priori* metaphysical laws which derive from human understanding (*i.e.*, the categories, the principles of understanding, and so on). Chapter four, based on the model given in chapter three, argues that Kant's approach to science need not be limited to physics, but could also be extended in principle to other sciences as contemporarily practiced, in this case, psychology. This task is complicated by Kant's explicit rejection of psychology as a science—but by placing Kant's criticisms of psychology in textual and historical context, chapter four argues that Kant's criteria for science could indeed apply to some aspects, at least, of contemporary psychology. Lastly, chapter five addresses the implications Kant's transcendental idealism has for the sciences. It argues that Kant's transcendental idealism is central to his philosophical system, and that the best way to reconcile his manifest empirical realism with his transcendental idealism is to recognize that, despite his empirical realism, he is best understood as also being committed to metaphysical anti-realism. Accordingly, we should adopt a two-aspects, rather than two-worlds, interpretation of transcendental idealism, because this interpretation accommodates Kant's empirical realism and metaphysical anti-realism.

To the memory of

Dr. Ron B. Moyron:

sage, wild man, brother

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Deo ac Veritati.

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CHAPTER 1

INTRODUCTION: KANT'S RESPONSE TO REGIONAL SKEPTICISM

In *Empiricism and the Philosophy of Mind*, Wilfrid Sellars argued that objects of knowledge are facts, and the idea that facts can be "analysed without remainder…into non-epistemic facts" is a "radical mistake" (Sellars 1991, 128, 131). Briefly stated, a fact is something that occurs in "the logical space of reasons," meaning that it is something that can be justified (ibid., 169). Sellars argued that, given these premises, experience cannot constitute an epistemic fact—or, in other words, be a "self-authenticating nonverbal episode," or state of knowledge— without a pre-existing context of experience and observational knowledge (ibid.). McDowell, inspired by Sellars, also claimed that justification for knowledge claims can only occur within the space of reasons, or what he termed the "conceptual sphere" (1996, 7). "Conceptual," on this view, denotes either seeing or judging "*that things are thus and so*" (ibid., 9). McDowell and Sellars were of a mind insofar as they both claimed that the justification is a matter of giving reasons, and, therefore, a bare perceptual experience can be neither self-authenticating nor grounds for other knowledge claims.[1]

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[1] The merits of this argument are beside the point for the moment, though it bears noting that not all agree with its premises. Bermudez, for example, argues that "nonconceptual content can provide reasons for perceptual judgements without standing in logical relations to them," in that it is the "perceptual discrimination of objects and properties" that is nonconceptual and which gives warrant to perceptual judgments (2009, 465-66). In any event, we should also note that McDowell and Sellars differ in some important respects. McDowell argues that perceptual experience is intrinsically conceptual and that there is no separable non-conceptual, or non-cognitive, component (ibid., 9). On the other hand, Sellars does not disavow that there is a non-cognitive constituent of perceptual experience. *See* Sellars 1965, 436.

McDowell drew inspiration not just from Sellars but from Kant and his pronouncement in the *Critique of Pure Reason* that "[t]houghts without content are empty, intuitions without concepts are blind" (McDowell 1994, 6) (citing B 75).[2] McDowell interprets Kant to mean that "adequately justified" representational content needs both concepts (*i.e.*, the exercise of reason) and intuitions (experiential intake) (1994, 6). That is, while McDowell does not consider himself in agreement with the entirety of Kant's epistemology and metaphysics,[3] he does attribute to Kant an interest in the issue of justification. McDowell is not the only one; it is often taken as a given that Kant was concerned with justification. For example, McLear notes that Kant maintains relevance to "enduring issues of philosophical interest," such as how we form "basic perceptual belief[s][,] and the epistemic warrant we attain for such beliefs" (2016, 172). Gomes likewise notes that Kant's treatment of this issue "has implications for contemporary debates about the involvement of concepts in perceptual experience and our relation to non-concept-using animals" (2017, 13).[4]

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[2] The throughline runs from Kant, through Sellars, to McDowell. See, e.g., Gomes 2017, 20 (observing that McDowell among others, "revitalized interest in Sellars," the latter of whom presented his views as "Kantian insights").

[3] McDowell has described the transcendental elements of Kant's philosophy (specifically his distinction between noumena and phenomena) as "profoundly unsatisfactory" (1994, 43). *Accord* ibid., 82. Schafer and Stang observe, in line with McDowell's expressed dissatisfaction, that Kant scholarship in the twentieth and (early) twenty-first centuries has been dominated by "deflationary reading[s]" of Kant's "noumenal discourse" (that is, deflationary readings of Kant's positions vis-à-vis noumena), but, they note, recent scholarship has begun to "favor . . . a more metaphysically committal reading of noumenal discourse" (2022, 3).

[4] Gomes further observes that the "Kantian approach to the philosophy of mind didn't and doesn't consist in any agreed set of theses," but rather "involves .

Biographer Manfred Kuehn likewise argues that Kant's aim in the first *Critique* is an epistemological one, namely, to show that knowledge, insofar as it lays claim to necessity about the way the world is, has an *a priori* foundation rooted in our cognitive makeup (2001, 242).[5] If this is the case, then Kant indeed was concerned with what epistemic warrant our knowledge claims have (to the extent that they purport to apply necessarily to the world).

. . a shared understanding of the relevant problems and a common tradition of interlocutors who are engaged in addressing those problems" (2017, 21). It is this very lack of consensus—about the details of a Kantian solution to issues in the philosophy of mind and epistemology—that leaves room for projects such as this one, which attempt to develop and propose viable Kantian solutions in these domains.

Gomes identifies some of the themes common to Kant scholarship on these issues: (1) whether there is a necessary structure to human thought and experience; (2) what the link is between consciousness and self-consciousness/normativity; and (3) the rejection of a "Cartesian self" (ibid., 21-23). McLear also notes that Kant's concept/intuition formulation serves as an "important vehicle for asking and answering questions regarding the relation between thought and reality," including how thought can be about "objective reality," and how sensory experiences could have "normative, rather than merely causal, significance for the subject's thinking" (2021, 1).

While we may find what has been described as "an almost vicious lack of terminological clarity on Kant's part, which has the unhappy consequence that one will always find passages that seem to contradict whatever it is one thinks one has discovered about his considered views" (Horstmann 2018, 49), which perhaps compels us to give up the search for a definitive interpretation of Kant, we may nevertheless attempt to pull substantive and valuable insights from good faith interpretations of his work.

[5] *Accord* Kitcher 1990, 191 (asserting that Kant's "sole objective [in the first *Critique*] is to determine what our cognitive powers must be like if they are capable of producing knowledge"); ibid., 195 (Kant's project was to show how concepts and intuitions were "necessary for the production of warranted beliefs), and ibid., 207 (Kant was "deeply concerned with the possibility of obtaining knowledge or justified belief").

Kuehn maintains that Kant's goal was to provide an answer to Hume's skepticism about necessary knowledge claims; but, even so, Kuehn claims, Kant "did not mean to refute a global skepticism about all claims to knowledge," but saw himself as "responding to a local skepticism" about whether we can lay claim to knowledge in metaphysics rather than knowledge claims generally (2001, 264). However, Kuehn's interpretation of Kant's project is at odds with one such as McDowell's, according to which Kant's insight was that *empirical* knowledge requires justification, which can only occur within the space of reasons.

To discern Kant's philosophical position in the first *Critique* requires an understanding of what problem he aimed to solve. To the extent his inquiry was epistemological, was his concern directed at justification of knowledge claims against local, global, or some other sort of, skepticism? Only after we address these questions can we properly move forward with determining what his proposed solutions are; and only after pinning down his solutions can we situate, and evaluate, them in context of contemporary work on related issues. To this end, this chapter will emphasize the epistemological dimension of Kant's first *Critique* and argue that Kant's concern was to provide warrant for knowledge claims in both metaphysics and in natural science.

1. The Most Difficult of All Reason's Tasks: Self-Knowledge

In the preface to the first edition of the first *Critique*, Kant explained that the "critique of pure reason" is a "court of justice, by which reason may secure its rightful claims . . . according to its own eternal and unchangeable laws" (A xi-xii). As he further explained:

> Yet by this[, *i.e.*, the "critique of pure reason,"] I do not understand a critique of books and systems, but a critique of the faculty of reason in general, in respect of all the cognitions after which reason might strive **independently of all experience,** and hence the decision about the possibility or impossibility of a metaphysics in general, and the determination of its sources, as well as its extent and boundaries, all, however, from principles (A xii).

There is thus some ambiguity in the preface to the first edition in that it is less than clear what "eternal and unchangeable laws" the critique of pure reason discerns, *i.e.*, whether the "laws" are limited to the laws of thought or whether they extend to metaphysical laws that govern the natural world. Kant similarly—and ambiguously—proclaims in the first preface that, "I make bold to say that there cannot be a single *metaphysical problem* that has not been solved here, or at least to the solution of which the key has not been provided" (A xiii) (emphasis added). So what is not yet clear based on the preface is whether the *Critique* is intended to solve metaphysical problems or to perhaps provide keys for solving those problems.

Toward the end of the first preface, Kant implies that the *Critique* is a guide for metaphysical problem-solving:

> Now metaphysics, *according to the concepts we will give of it here*, is the only one of all the sciences that may promise that little[,] but unified[,] effort, and that indeed in a short time, will complete it in such a way that nothing remains to posterity . . . (A xix – xx) (italics added).

This suggests that the *Critique* will provide concepts for metaphysics to use, such that readers of the *Critique*, employing the method of the *Critique*, will be able to "in a short time" complete a science of metaphysics, that is, discern a complete metaphysical system. That the *Critique* is an antecedent to metaphysics is further supported by Kant's declaration that he hopes to complete it himself:

> Such a system of pure (speculative) reason I hope myself to deliver under the title **Metaphysics of Nature**, which will not be half so extensive but will be incomparably richer in content than this critique, which had first to display the sources and conditions of its possibility, and needed to clear and level a ground that was completely overgrown (A xxi).

Thus, toward the end of the first preface, Kant contrasts the *Critique* with the "incomparably richer" proposed project *Metaphysics of Nature* in which he would present a "system of pure (speculative) reason." It follows from this that the *Critique* is not a metaphysical system *per se*, but a foundation setting forth the "sources and conditions" for the possibility of metaphysics.

In the preface to the second edition, Kant is less ambiguous about whether the *Critique* is a metaphysical or epistemological project; he more clearly explains that the *Critique* is intended to present a method for engaging in metaphysics. He observes that mathematics had "traveled the secure path of a science" from "the earliest times to which the history of human reason reaches," and that physics had recently found "the highway of science" (B x-xii).[6] Metaphysics, on the other hand, "has up to now not been so favored by fate as to have been able to enter upon the secure course of a science," but, instead, we "retrace our path countless times" without reaching consensus (B xiv – xv).

Kant explains that his critique is intended to transform the "procedure" of metaphysics, in line with math and physics:

[6] In the *Metaphysical Foundations of Natural Science*, Kant argues that any system of cognition can be a science if it has an "apodictically certain" ground (*i.e.*, has as its foundation *a priori* principles that necessarily obtain); but if the system contains laws derived only from experience, then it "does not deserve the name of a science in the strict sense" (4: 468).

> Now the concern of this critique of pure speculative reason consists in that attempt to transform the accepted procedure of metaphysics, undertaking an entire revolution according to the example of the geometers and the natural scientists. *It is a treatise on the method, not a system of the science itself*; but it catalogs the entire outline of the science of metaphysics, both in respect of its boundaries and in respect of its entire internal structure (B xxii) (emphasis added).[7]

Consistent with the first preface, in the second, Kant observes that if the *Critique* can put metaphysics on the "secure course of a science," then metaphysics could "complete its work and lay it down for posterity as a principal framework that can never be enlarged . . ." (B xxiii – xxiv). Kant later refers in the second preface to a "systematic metaphysics[] constructed according to the critique of pure reason . . ." (B xxx). Criticism, Kant says, "is the *preparatory activity* necessary for the advance of metaphysics as a well-grounded science…" (B xxxvi) (emphasis added).[8]

The prefaces to the first and second editions of the *Critique* manifest Kant's purpose, *i.e.*, to set metaphysics on the course of becoming a science by

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[7] *See also* Butts 1986a, 5 (describing the first *Critique* as Kant's "proper method for metaphysics," with the "concrete examples" of metaphysics contained in the *Metaphysical Foundations*).

[8] Kant inserts an autobiographical detail in the second preface, namely, that he had just turned sixty-four years' old, and, accordingly, "I must proceed frugally with my time if I am to carry out my plan of providing the metaphysics both of nature and morals, as confirmation of the correctness of the critique both of theoretical and practical reason…" (B xliii). This further evinces the preparatory nature of the *Critique* as an epistemological foundation for subsequent construction of a metaphysical system. Gomes notes that while "disciplinary boundaries are somewhat artificial and many philosophical projects fall under more than one category," the first *Critique* is "often most straightforwardly categorized as a work of epistemology and metaphysics" (2017, 5).

providing what he describes as a treatise on methodology.[9] It is a critique of our use of reason which will thereby establish its possibilities and limitations, and accordingly, the possibilities and limitations of the metaphysical systems it creates.

Having shown that Kant's project is epistemological in that it is concerned with the foundations, possibilities, and limitations of metaphysical knowledge—without denying that there is a metaphysical dimension to the work—we must still resolve whether Kant intended for his arguments to have wider import (that is, whether he intended to address global or local skepticism, or something in between).

2. Interlude: Kant's Progressive and Regressive Method

The present chapter argues that one of Kant's primary motivations in the first *Critique* is to address skepticism about a certain class of knowledge claims; and, following his Copernican revolution, he intends to accomplish this by looking at the structure of human understanding, and, thereafter, establish knowledge claims about the world as it appears to us. If this is the case, then I maintain we should read the first *Critique* as a whole in this light, *contra* Allais, who argues that "Kant's primary concern in the *Critique* is with cognition rather

[9] The above demonstrates that one of Kant's priorities is the justification of metaphysical knowledge claims—after all, the *Critique* is intended to lay a foundation establishing the sources, possibility, and boundaries of metaphysics. *See, e.g.*, A xii. But there are other statements evincing the *Critique's* purpose. Kant says that metaphysics, formerly the "queen of all the sciences," has come to inspire "tedium and complete indifferentism," because all of its paths have been "tried in vain" (A x). This "ripened power of judgment" of the age "demands that *reason should take on anew the most difficult of all its tasks, namely, that of self-knowledge….*" (A xi) (emphasis added).

than knowledge" (2017, 31). Allais implies that Sellars and McDowell—who take issue with the Myth of the Given based on philosophical positions derived from Kant—miss the mark, because Kant's "concern with cognition . . . is not primarily about knowledge or justification, but rather with a certain kind of objective representation" (ibid.). The main thesis of my argument, set forth below, is that the plain text of the first *Critique*, particularly, the introductory sections—which set forth the motivations and scope of the book—evince Kant's strong concern with knowledge and the related issue of justification, which is compatible with Kant's treatment of objective representation.

The interpretation offered here also contrasts with those who maintain that Kant's transcendental arguments, specifically certain passages in the first *Critique*, such as the Transcendental Deduction, are not concerned with answering skepticism, but instead assume that we have empirical knowledge and thereafter seek to show the preconditions of that knowledge. *See*, e.g., Ameriks 2003, 50. Ameriks notes that the sort of argument which "accept[s] empirical knowledge as a premise to be regressively explained rather than as a conclusion to be established" is a "regressive" or "analytic" argument, as compared to a "progressive" or "synthetic" argument, which starts with minimal premises about awareness and reasons toward empirical knowledge. *See* ibid., 54; *accord* (Gava 2013, 731, 736) (agreeing with Ameriks insofar as he claims that Kant "takes some aspects of our experience as given and identifies which conditions are necessary to account for them").

Tolley, however, argues that the regressive reading of Kant fits poorly with the text for several reasons, including that this reading would make Kant's argument less compelling to his contemporaries (such as Hume) because it "would seem to beg almost all of the relevant questions" about empirical cognition (2022, 65). I propose, in line with Tolley, that the determination of whether Kant's argument is a progressive or regressive one is best adjudicated by taking it as true that "Kant really means what he says in the *Prolegomena* about the method of the *Critique*—that it is really meant to offer progressive or synthetic arguments . . .." (2022, 65).[10] Kant, for example, notes early in the *Prolegomena* that the method of the *Prolegomena* is regressive, or "analytic," that is, the method according to which "one proceeds from that which is sought as if it were given, and ascends to the conditions under which alone it is possible" (4: 276 n.), contrasted with the progressive/synthetic method of the first *Critique*, according to which a reader may "think himself little by little into a system that takes no foundation as given ***except reason itself***, and that therefore tries to develop cognition out of its original seeds without relying on any fact whatever" (4: 274) (emphasis added). (Whether Kant fully abides by his own intention is a separate question from what his intention was. Guyer seems

[10] Ameriks states that the way he uses "regressive" is not identical with Kant's use of the term in the *Prolegomena*, because, according to Ameriks, Kant uses argumentation in the *Prolegomena* that "presuppose[s] not only experience but also specific pure and scientific principles" (2003, 8). However, this is not material for the discussion here because, as Ameriks notes, there is a "more basic but still in some sense regressive argument in Kant's more fundamental discussions in the *Critique* . . . that goes from ordinary experience to the original need for pure components" (ibid.). In other words, a regressive argument—whether in the *Prolegomena* or the first *Critique*—reasons from a given thing (experience, or experience plus scientific principles) to the necessary conditions of our having that thing. Therefore, the general distinction between the types of arguments, *i.e.*, progressive and regressive, obtains regardless of the thing(s) from which we reason regressively.

to have charted a middle course according to which Kant's "twofold aim" was "to both prove *that* we have synthetic *a priori* cognition . . . and then explain *how* such knowledge is possible" (2004, 49); additionally, Guyer asserts that in the Transcendental Analytic, which includes the Transcendental Aesthetic and Deduction, Kant used both methods (2004, 49 fn.10). The interpretation provided here is generally consistent with Tolley and Guyer.)[11]

3. "Regional Skepticism": Between Global and Local Skepticism

There is good reason to believe that Kant is not concerned with empirical knowledge. As noted above, the *Critique*'s concern is metaphysical knowledge, *i.e.* knowledge of that which is unchanging and which holds with necessity, which is ascertained "independently of all experience" (A xii). Cognition which occurs "*absolutely* independently of all experience" is *a priori*, contrasted with *a posteriori* cognition, *i.e.*, "empirical cognitions," or those which are "possible only…through experience" (B 2-3).[12] As the *Critique* addresses metaphysical

[11]Ameriks argues that nowhere does Kant state that the Transcendental Deduction's purpose "is to give the sufficient conditions of empirical knowledge or [to be] a proof that there is an objective world" (2003, 58). However, the Transcendental Deduction must be situated in context of the purpose of the first *Critique* as a whole; and the present chapter argues that we must understand Kant's project as, at least in part, an epistemological one insofar as it seeks to defend the possibility of certain classes of knowledge from skeptical attacks. *See* Tolley 2022, 48 (stating that Kant's aim in the first *Critique*, as well as the *Prolegomena*, is to show whether human reason "is capable of achieving the kind of cognition . . . traditionally…thought to belong to metaphysics, or whether instead the tradition of skepticism . . . (then most recently associated with Hume) is correct . . ..").

[12] "Cognition" is a term of art for Kant and is the subject of considerable discussion below in chapter two. For present purposes, a more general definition will suffice. Cognition may be defined as: "[P]rocesses responsible for knowledge and awareness. They include the processing of experience, perception, and memory, as well as overtly verbal thinking" (Blackburn 2016). Empirical

knowledge, that is, *a priori* cognition, it would appear that empirical knowledge is excluded from the *Critique's* scope, given that the *sine qua non* of empirical cognition is that it derives from experience. *See* B 2. That is, insofar as metaphysics makes necessity claims about the world, it is *a priori*, and so the justification of metaphysics claims is justification of *a priori* knowledge; and, thus, it is inapplicable to knowledge sourced from experience. Thus, it would indeed appear that the problem Kant is attempting to solve is local skepticism rather than general skepticism.

This conclusion, however attractive, is hasty. As will be shown further below, for Kant, proper science discerns laws that govern the empirical world with necessity; and this necessity derives from metaphysical principles. So the justification of metaphysical knowledge lays the foundation for justification of laws in natural science. If this is the case, then Kant's concern is something more than local skepticism, but something less than general skepticism, for which I will use the term "regional" skepticism. But we need not accept this conclusion without evidence.

A good starting point is to lay out the metaphysical problems with which Kant is concerned. Kant observes that metaphysicians "inevitably involve themselves" in "disputes" resulting in "scandal," and, so,

> [t]hrough criticism alone can we sever the very root of **materialism fatalism, atheism,** of freethinking **unbelief**, of **enthusiasm** and **superstition,** which can become generally injurious, and finally also of **idealism** and **skepticism**, which are

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cognitions, viz., objective representations of empirical objects, formed through a subject's combination of sensory input (intuitions) according to *a priori* rules (concepts) will be discussed in depth in the next chapter.

> more dangerous to the schools and can hardly be transmitted to the public (B xxxiv).

According to Kat, reason errs when it—as Plato did—"abandon[s] the world of the senses because it pose[s] so many hindrances for the understanding," and enters "the empty space of pure understanding" (B 8-9). Reason similarly errs when it strays too far in the opposite direction, as Hume did, by seeking to derive necessary connections from our empirical observations (B 5, 19-20). In the former case, reason becomes unmoored and loses its foundation and connection with reality; in the latter, reason seeks to uncover necessary laws that can never be definitively ascertained through observation—and when it fails to discern necessity from observation, it falls into skepticism.

Kant reasonably notes that "[o]ne has already gained a great deal if one can bring a multitude of investigations under the formula of a single problem" (B 19). That is, if we can subsume under a more general formulation the various errors reason succumbs to, then we can more efficiently correct these errors by way of solving the more general problem. Kant formulates the general problem as follows: "How are synthetic judgments *a priori* possible?" (ibid.) (emphasis omitted). He elaborates:

> That metaphysics has until now remained in such a vacillating state of uncertainty and contradictions is to be ascribed solely to the cause that no one has previously thought of this problem and perhaps even of the distinction between **analytic** and **synthetic** judgments (ibid.).

This reveals that, for Kant, the key to solving any number of metaphysical conundrums may be found by solving the question of what makes synthetic *a* *priori* knowledge possible. To understand why that is the case, however, we must further discern what distinguishes synthetic from analytic *a priori* judgments.

Kant provides the following elucidation: An analytic judgment is one in which some predicate B—which belongs to subject A—is already contained in the concept A (B 10). In an analytic judgment, the connection between the subject and predicate is identity, and, accordingly, analytic judgments, also known as "judgments of clarification," do not "add anything to the concept of the subject, but only break it up by means of analysis into its component concepts, which were already thought in it (though confusedly)" (B 11). Conversely, synthetic judgments are those in which the predicate B "stands in connection" with some subject A, but it "lies entirely outside the concept" of A (B 10). So a synthetic judgment—also known as a "judgment of amplification"—adds to its subject's concept "a predicate that was not thought in it at all[] and could not have been extracted from it through any analysis" (B 11). Thus, for example the "concept of body" would include within it "extension," such that "all bodies are extended" is an analytic judgment, whereas "all bodies are heavy" would be a synthetic judgment, since the predicate "heavy" is not contained within the concept of "a body in general" (B 11 - 12).

To elucidate: Judgments of experience, Kant claims, are all synthetic since they go beyond conceptual analysis and draw on evidence from experience for support (B 11-12). So, judgments of experience are synthetic (as they go beyond a given concept) and they are also *a posteriori* (that is, they depend on experience). Analytic judgments are made *a priori*; and all experiential (*i.e.*, *a posteriori*) judgments are synthetic. But are synthetic *a priori* judgments possible? (This question logically precedes that which Kant identifies as crucial, namely, *how* are synthetic *a priori* judgments possible?)

It is appropriate to pause here to consider why we should care about synthetic *a priori* judgments in the first place. Kant identifies an exemplar: "Everything that happens has its cause." This simple proposition—if we take it to be a maxim according to which the world necessarily operates—is *a priori* (owing to its necessity), but also synthetic. As Kant explains:

> In the concept of something that happens…analytic judgments can be drawn. But the concept of a cause lies entirely outside that concept, and indicates something different than the concept of what happens in general, and is therefore not contained in the latter representation at all (B 13).

If the concept of an event does not contain within it the concept of a cause, then how can we say with necessity that every event has a cause? Whatever it is that links the concept of cause with the concept of an event cannot derive from experience, because the link between cause and effect applies with "greater generality than experience can provide, but also with the expression of necessity, hence entirely *a priori* and from mere concepts" (B 13). If we care about being able to establish, with necessity, a link between cause and effect, then we must care about synthetic *a priori* judgments. In fact, it is a failure to address this precise problem that caused Hume to fall into error. According to Kant, Hume has the distinction of recognizing that the judgment of cause and effect is a synthetic one; but from there, Hume erred in concluding that this judgment could not possibly be an *a priori* proposition (B 19-20). Thus, we care about synthetic *a priori* judgments because metaphysics—to the extent it can say anything about the world with necessity—rests on the synthetic *a priori*.

Having established why we should care about synthetic *a priori* claims, our next question—on our way to the ultimate question of *how* synthetic *a priori* judgments are possible— is *whether* we make synthetic *a priori* judgments. For Kant, mathematical judgments are synthetic, but also *a priori*. They are *a priori* because of their necessity, which "cannot be derived from experience" (B 14). In arithmetic, Kant argues that the sum of two numbers—for example, 7 and 5 being 12—is a synthetic judgment because the concept of "7 + 5" contains nowhere in it the concept of "12," but instead requires "assistance in the intuition" corresponding to each number (e.g., some spatial representation of each number combined with the other) to compute the sum (B 15-16). Geometrical principles likewise contain synthetic *a priori* judgments. Another example Kant gives is the principle that the shortest distance between two points is a straight line: nothing in the concept of "the straight" contains "the shortest": "The concept of the shortest is therefore entirely additional to it[, *i.e.*, 'the straight,'] and cannot be extracted out of the concept of the straight by any analysis" (B 16). (This is not to deny that there are also analytic *a priori* principles in geometry, such as identity (B 17)).

Natural science likewise contains synthetic *a priori* principles. For example:

> [T]he proposition that in all alterations of the corporeal world the quantity of matter remains unaltered, or that in all communication of motion[,] effect and counter-effect must always be equal (B 17).

Kant takes these two propositions to be not only necessary, but synthetic, because the concept of "matter" contains "its presence in space through the filling of space," but it does not contain the concept of "persistence" (B 17-18). To get to the idea that matter persists through alterations, we go beyond the concept of "matter."

While Kant does not elaborate on this point much in the introduction to the *Critique*, it should be noted that Kant gives three categories, or three "sciences of reason," each distinct from the others, and each of which incorporates synthetic *a priori* principles: mathematics, natural science, and metaphysics. *See* B 14-18. So, insofar as the general problem of the *Critique* is an epistemological problem, the answer to the question of "how are synthetic judgments *a priori* possible?" provides justification for metaphysical claims and any science that contains synthetic *a priori* principles, including natural science. In sum: while Kant's aim is justification for metaphysical claims of necessity, insofar as natural science purports to discern laws of necessity—thereby resting on synthetic *a priori* principles—justification for natural science is a byproduct of Kant's program of developing justification for metaphysics.[13]

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[13] *See also* Brook 2007, 119 (noting that one of Kant's two goals in the first *Critique* was to "[j]ustify our conviction that mathematics and especially physics are a unified body of necessary and universal truth"). As an aside, note that this proposal—*i.e.*, that Kant was concerned with the justification for metaphysical claims of necessity, which trickle down, so to speak, to justification for necessity claims about empirical matters, the latter of which constitutes natural science—was anticipated by Boehm's interpretation of Kant's project. Boehm argues that Kant was concerned in the first *Critique* with scientific knowledge rather than knowledge in general; he asserts that, "in describing knowledge[,] Kant obviously had natural science, more specifically Newtonian mechanics, in mind from the beginning as the true prototype" (1986, 337). He points to Kant's emphasis on mathematics in the first *Critique* as well as the references therein to the *Metaphysical Foundations* (ibid., 338). Boehm goes still further and argues that Kant's epistemology stemmed from an Enlightenment-era tendency to alienate human beings from nature, that is, to take something familiar, of which we are a part, *i.e.*, nature, and to hold it at arms' length, to turn it into something strange which we must "domesticate" by subjecting it to "our own conditions of life, or, more generally, to our categories of understanding" (ibid., 342).

4. Kant's Copernican Revolution: The Link Between Metaphysics and Natural Science

This point—*i.e.*, the association between natural science and metaphysics—requires further attention, because our interpretation of Kant's epistemological project (that is, whether it is intended to combat general, local, or regional skepticism) turns on it. While the specific nature of the relation between natural science and metaphysics is the subject of chapter three below, what follows is a preliminary discussion establishing that there *is* a relation between the two.

In the *Metaphysical Foundations of Natural Science*, Kant elucidates the connection between natural science and metaphysics and further delineates the scope of what he takes "natural science" to be. "Nature," Kant says, can be understood as "the sum total of all things, insofar as they can be *objects of our senses*, and thus also of experience" (4: 467). As such, it is the entirety of the sensible world (ibid.).

Nature, as the totality of objects of experience, may be further subdivided into objects of outer sense and objects of inner sense (4: 467). We may approach objects based on whether they relate to outer sense (*i.e.*, "extended" nature) or whether they relate to inner sense (*i.e.*, mental things that have a "thinking" nature).[14] When we construct a system, that is, a "whole of cognition ordered

[14] Consideration of extended nature constitutes what Kant calls the "doctrine of body," whereas consideration of thinking nature constitutes "doctrine of the soul" (4: 467).

according to principles," that system is a "science" (ibid.). Natural science,[15] Kant provides, may be further subdivided into two categories, depending on whether it "treats its object wholly according to *a priori* principles" or "according to laws of experience" (4: 468). What Kant calls "proper" science is one whose certainty is necessary (and, accordingly, constitutes knowledge properly called), in contrast to "mere empirical certainty," the latter of which is science improperly called, and which constitutes "*knowledge* improperly so-called" (4: 468). This is a demanding standard, and not everything that we might presently consider a "science" qualifies. For example, chemistry, Kant argues, should be called a "systematic art rather than a science," because its laws are "mere laws of experience," that is, they are derived from experience and therefore have no *a priori* grounds and, accordingly, no necessity (4: 468-69).

"All *proper* natural science," Kant asserts, "requires a *pure* part, on which the apodictic certainty that reason seeks therein can be based" (4: 469). This claim is notable because therein Kant does not claim that "proper" natural science is limited to its "pure," or *a priori* part, but only that it must contain, in part, an *a priori* basis.[16] Natural science thus presupposes a "metaphysics of nature" (4: 469). Metaphysics of nature can be general, and concern transcendental laws, *i.e.*, those "which make possible the concept of a nature in

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[15] Kant distinguishes natural science from what he calls the "historical doctrine of nature," which is a body of "systematically ordered facts about natural things[,] [such as] *natural description*, [] a system of classification for natural things according to their similarities, and *natural history*, [] a systematic presentation of natural things at various times and places" (4: 468).

[16] From here on, unless otherwise specified, "natural science" should be taken as shorthand for "proper" natural science.

general, even without relation to any determinate object of experience";[17] or metaphysics of nature can be "special" in that it may

> concern itself with a particular nature of this or that kind of 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 its cognition (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)... (4: 470).

There is thus "special metaphysical natural science," which, in the case of the application of transcendental principles to corporeal nature, we have physics, and as applied to thinking nature, psychology (ibid.). In either case, to warrant being called a "proper science," its principles must be capable of being represented *a priori* (4: 471).

According to Kant, without our sensory capacities, we would have no cognition or experience of the external world; accordingly, the most basic predicate of matter must be "motion," since only through motion "can [our] senses be affected" by matter (4: 476). He additionally maintains that matter, in general, is necessarily subject to transcendental rules, specifically, the pure concepts of the understanding (i.e., quantity, quality, relation, and modality) (4: 475-76). So, the *a priori* basis of natural science (of corporeal nature) concerns motion, which is analyzed under the pure concepts of the understanding (4: 476-77).

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[17] Philosophy to the extent that it concerns *a priori* cognition of objects is transcendental. *See* A 11-12/B 25.

Each of the pure concepts receives its own section in the *Metaphysical Foundations*: the concepts correspond, respectively, to "phoronomy" (analysis of matter's capacity to be in motion); "dynamics" (account of how matter fills space "not through its mere *existence*," but by virtue of its "particular moving force"); "mechanics" (derivation of Newtonian laws from matter's forces of repulsion and attraction, and the communication of those forces from one body to another); and "phenomenology" (determination of matter's modality, that is, whether it is a possible, necessary, or impossible object of experience, and the relationship its modality has to motion or rest) (4: 477). Mechanics is key vis-à-vis physics because this is the section in which Kant derives Newtonian laws of motion from transcendental principles.

In the "mechanics" section, Kant attempts to prove the following: (1) "*First Law of Mechanics*: In all changes of corporeal nature the total quantity of matter remains the same, neither increased nor diminished"; (2) "*Second Law of Mechanics*: 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"; and (3) "*Third mechanical law*: In all communication of motion, action and reaction are always equal to one another" (4: 537, 4: 541, 4: 543, 5: 544). These laws (imperfectly) correspond to Newton's laws of motion, which form the foundation of his mechanics (*see also* Guyer 2006, 162).[18] Because of

[18] Newton's laws of motion are defined as: "(1) A body continues in a state of rest or uniform motion in a straight line unless it is acted upon by external forces. (2) The rate of change of momentum of a moving body is proportional to and in the same direction as the force acting on it . . . (3) If one body exerts a force on another, there is an equal and opposite force, called a **reaction**, exerted on the first body by the second" (Rennie and Law 2017).

the *a priori* substratum of physics, physics is distinguished as being a proper science, in contrast to something like chemistry, which has only empirical principles, and therefore no necessary *a priori* foundation, and which can never rise above being what is more properly termed a "systematic art." Again, this entails that the first *Critique*, insofar as its aim is justification for metaphysics, also justifies natural science, to the extent that the science in question has a metaphysical substratum.

While the emphasis so far here has been on physics, owing to Kant's treatment of the subject as a "proper" science in *Metaphysical Foundations*, recall that Kant also says that objects of cognition may be either inner or outer. A system of *a priori* principles applied to objects of outer sense lays the foundation for physics. A system of *a priori* principles applied to objects of inner sense is "psychology" (4: 470). So, by analogy to physics, psychology could constitute a proper natural science for Kant, to the extent that it is derivable from a system of

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To make more explicit the connection between Newton's laws of physics and *a priori* laws: Kant claims that the smallest indivisible body of matter is an atom; and "[t]he mode of explaining the specific variety of matters by the constitution and composition of their smallest parts, as machines, is the *mechanical natural philosophy*" (4: 532). So "mechanical natural philosophy" is the explanation of a whole by its parts, and the laws governing those parts are the laws of motion, which are derived from transcendental laws; and transcendental laws prescribe causal necessity. Kant's *Metaphysical Foundations* thus corroborates the idea that Kant took "mechanical laws" to be the laws of motion which govern the empirical world (whole objects, but more specifically their particles) with causal necessity, and that necessity is derived from the transcendental foundation underlying Newtonian physics. In line with this, Guyer, for example, observes that Kant's *Metaphysical Foundations* represented an attempt, in light of his Critical philosophy, to "derive the fundamental principles of Newtonian physics by applying his synthetic *a priori* principles of experience to the concept of matter as that which is moveable in space" (2006, 34).

a priori principles applied to objects of inner sense. However, despite establishing this framework in the *Metaphysical Foundations*, Kant would go on to reject the possibility of psychology as a science on par with physics for reasons discussed below in chapter four.

Nevertheless, I will argue that Kant's rejection of a narrow sense of psychology does not preclude the development of a Kantian approach to psychology as a science, and, moreover, Kant's psychological insights anticipated contemporary theories in cognitive science. So, while we address the first *Critique's* application to physics again in chapter three, the extrapolation and application of Kant's *a priori* principles from the first *Critique* to psychology will be a theme we return to in chapter four. For now, we must limit ourselves to the task at hand, namely, to discern the aim and scope of the first *Critique*.

The account Kant gives in *Metaphysical Foundations* of the relation between metaphysics and natural science accords with certain assertions Kant makes in the first *Critique*: reason must establish "constant laws and compel nature to answer its questions, rather than letting nature guide its movements by keeping reason, as it were, in leading strings," if we are to discern necessary laws (B xiii). It is worth quoting at length Kant's account of how reason and natural science work together:

> Reason, in order to be taught by nature, must approach nature with its principles in one hand, according to which alone the agreement among appearances can count as laws, and, in the other hand, the experiments thought out in accordance with these principles—yet in order to be instructed by nature not like a pupil . . . but like an appointed judge who compels witnesses to answer the questions he puts to them (B xiii).

Kant goes on to make it explicit: physics, in order to determine necessary causal laws, must seek in nature "in accordance with what reason itself puts into nature" (B xiii – xiv).

In *Metaphysical Foundations*, Kant explains that the *a priori* principles established in metaphysics are not only those underlying physics, but are also the same ones that govern our empirical representations, which become empirical experience:

> All true metaphysics…contains the pure actions of thought, and thus *a priori* concepts and principles, which first bring the manifold of *empirical representations* into the law-governed connection through which it can become *empirical* **cognition**, that is, experience (4: 472).

Thus, the first *Critique* ascertains the *a priori* principles that make not just metaphysics, but experience, possible as well. This is reflected in Kant's declaration in the *Metaphysical Foundations* that the *a priori* pure concepts of the understanding, discussed in the following chapters, determine all "determinate object[s] of experience" (4: 475).[19] However, unlike with natural science, it is not immediately clear how *a priori* principles—even if we assume *arguendo* that they govern empirical representations thereby making experience possible—justify empirical experience or judgments. To clarify, we must further explore the link between metaphysics and experience.

As we have seen, an observation that Kant returns to repeatedly is that metaphysics has failed to progress, unlike science and mathematics. One of the

[19] In a footnote, Kant similarly maintains that the pure concepts of the understanding, when applied to sensory input, constitute objects of experience. (4:75 n.).

principal reasons for this failure is that metaphysicians have neglected to lay a firm foundation for their theorizing (that is, to engage in a critique of their faculty of reason prior to exercising it). That is one methodological oversight Kant aims to remedy in the *Critique* overall. But there is one more fine-grained methodological correction: up to the then-present, Kant notes, "it has been assumed that all our cognition must conform to the objects" of cognition—but this has been fruitless (B xvi). If the assumption of metaphysics has been that cognition must conform to objects of cognition, and this has borne no fruit—then, instead, Kant hypothesizes, we might be better served by "assuming that the objects must conform to our cognition" (ibid.). In which case, if we instead assume that objects conform to our cognition, then the world as it appears to us necessarily presupposes the *a priori* rules governing our cognition (B xvii – xviii).

It is this so-called Copernican revolution, this paradigm shift,[20] that permits metaphysics to say anything *a priori* about the objects of experience:

> [W]e can [thus] provide satisfactory proofs of the laws that are the *a priori* ground of nature, as the sum total of objects of experience –

[20] The term "paradigm shift" is intentional. Thomas Kuhn defined a paradigm as a composite of "law, theory, application, and instrumentation together," which constitutes a tradition of research, and which guides further inquiry by specifying what entities exist, how they behave, and which questions are unexplained but will need to be explained as scientists further expand on and articulate the paradigm (2012, 10-11). When one paradigm is inadequate to move a discipline forward, another one, incommensurate with the first, ultimately displaces it. *See* ibid., 144, 147-49. While it would be ahistorical to attribute the term "paradigm shift" to Kant, in essence, this is exactly what he proposes. That said, it has not gone unnoticed that there is some irony in Kant comparing his methodological turn with Copernicus', given Kant's shift revolves around privileging human cognition whereas Copernicus downplayed our role as observers by positing a heliocentric solar system instead of a geocentric one. *See, e.g.*, Guyer 2006, 50.

> which were both impossible according to the earlier way of proceeding (B xix).

This method, which promises to justify our ability to say anything with necessity about the world has a catch: it is inseverable from Kant's transcendental idealism. Kant calls it a "very strange result," which may "appear[] very disadvantageous" at first; it is that "we can never get beyond the boundaries of possible experience" (B xix). In other words, this method can prescribe *a priori* rules to the world as it appears in our experience of it, but "such cognition reaches appearances only, leaving the thing in itself as something actual for itself but uncognized by us" (B xx).

In sum: the *a priori* rules governing human cognition are equally applicable to metaphysics (and, *via* metaphysics natural science). In establishing the *a priori* principles of our cognition, we justify metaphysics (and, accordingly, any "proper" natural science, *i.e.*, one, such as physics, that has metaphysics at its base). The *a priori* rules governing human cognition also equally determine the manner in which we cognize (or experience) empirical objects.[21] That said, although justification for metaphysics—and natural science—is a primary motivation for Kant in the first *Critique*, the question of what justifies empirical thinking (as far as it is *not* natural science) is not a question Kant expresses concern for, though we might reasonably theorize about how his philosophical system might address the issue.

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[21] As Allais notes, and to which we will return below in chapter four, "Kant's account of the complex contributions that must be made by the mind in order to enable us to have experience of a world seems to anticipate developments in cognitive psychology in ways that have interested many philosophers" (2017, 27).

5. Conclusion

The contemporary concern with epistemic warrant indeed has roots in Kant, who makes clear in the preface and introduction to the first *Critique* that his aim is, at least in part, epistemological: he observes that experience itself can never justify necessity claims, but instead "only an arbitrary increase in validity from that which holds in most cases to that which holds in all." As such, if necessary and universal claims about the world are possible, it must be, he argues, because there is an *a priori* foundation (B 3 – B 4). Kant's project then, as we have seen, extends to metaphysics and any sciences that are grounded in metaphysics. But this project does not extend to justification for any other sorts of beliefs or knowledge claims. Accordingly, it is ahistorical to suggest that Kant's concern was justification of everyday empirical beliefs.

Nevertheless, Kant did argue for how our experiential representations must occur, *i.e.*, according to *a priori* rules of cognition, which involves some yet-to-be specified interaction of concepts (thought or judgment) and intuition (sensation). Thus, to the extent that Kant proceeded to delineate what he took to be the nature of the relation between concepts and intuition, his thought can rightly be said to lay the foundation for Sellars', in particular, as well as McDowell's, later extensions, though Kant's project is not co-extensive with theirs.

Kant's aim, then, is more than countering local skepticism about knowledge claims in metaphysics, but less than countering general skepticism about knowledge claims. Accordingly, and as argued above, we might instead characterize it as refuting “regional” skepticism, understanding the “regions” in question to be not just metaphysics, but metaphysics and natural science.

CHAPTER 2
PRELIMINARIES: KANT'S INTELLECTUALISM

Recall that one of Kant's motivations in the first *Critique*, as argued above, is to respond to Humean skepticism about our ability to claim knowledge of necessity about relations in the empirical world. To recapitulate the previous chapter: Recognizing, courtesy of Hume, that necessity can never be established through the empirical observation, Kant proffered the hypothesis, owing to his "Copernican revolution," that if we are to discern necessity, it cannot be something we attribute to the sensible world based on our observations of it, because we never observe necessity. Instead, necessity must derive from our representations of the sensible world. In this way, the world, as represented, is necessarily governed by any rules that necessarily govern our representations. Accordingly, if we discover necessity in our representations, then we have discovered necessity in the world *as it appears* to us. Thus, Kant's epistemological project hinges on his transcendental idealism. This chapter will proceed by showing that, for Kant, the rules that necessarily govern the relations between judgments, *i.e.*, the categories, also prescribe how we form representations of the world.

1. Sensibilism and Intellectualism

Having a *telos* is a useful first step in forging a path forward. We begin with the Transcendental Deduction, as many accept it to be the strongest evidence for the view that the categories are necessary for empirical intuition. *See* Golob 2016, 34-35 (acknowledging the Transcendental Deduction is generally accepted for this purpose, and calling it the "standard view," but nevertheless rejecting it). The Transcendental Deduction has also been described as one of two chapters in the first *Critique* "in which most of Kant's remarks on the mind occur" (the other being the Paralogisms) (see Brook and Wuerth 2020, 6); the Transcendental Deduction is thus the natural starting point for discerning Kant's views on the mind.

That said, note that Kant, toward the end of the Transcendental Deduction, argues:

> [A]ll possible perceptions, hence everything that can ever reach empirical consciousness . . . stand under the categories, on which nature . . . depends, as the original ground of its necessary lawfulness . . ." (B 164-65).

Thus, according to Kant, any possible perceptions, *i.e.*, objects of conscious perception, are subject to the categories. And he defines the categories as "concepts that prescribe laws *a priori* to appearances, thus to nature as the sum total of all appearances . . .." (B 163). While we must develop and clarify this terminology (including, specifically, "perception"), already we see Kant's argument taking shape: for Kant, the categories (*i.e.*, rule-giving concepts) prescribe rules that regulate our perceptions (that is our representations of the sensible world).

The contemporary parlance is to use the term "intellectualism" to refer to representations which depend on mental activity, or synthesis, and "sensibilism" to refer to those representations which do not require synthesis. *See*, *e.g.*, McLear 2016, 172. The benefit of using the term "intellectualism" is that we avoid getting bogged down in intractable contemporary debates about conceptualism and need not take a stance on whether we should try to classify

Kant as a conceptualist or non-conceptualist or even distinguish between "state non-conceptualism" and "content non-conceptualism" (the former holds that "a mental state has non-conceptual content if and only if it is possible to be in the state without possessing or applying any of the concepts that characterize the content of the state," and the latter provides that a mental state "has non-conceptual content if and only if that mental state has a different kind of content than do beliefs and thoughts[, *i.e.*, conceptual content]" (Grüne 2022, 91)). *See also* Hanna 2016, 101 n.3.[22]

McLear adroitly notes that if we focus on Kantian conceptualism, we run the risk of getting mired in the "extraordinarily wide range of views concerning the existence and nature of concepts" (2016, 181). The myriad distinctions delineated above confirm this risk. Indeed, some question the utility of these distinctions. Bermudez, for example, argues that state nonconceptualism is unhelpful because it is unable to provide a "principled distinction between concept-dependent state types and concept-independent state types" without collapsing into the content view (2009, 459-461).

Accordingly, if we adopt broader categories of intellectualism and sensibilism, we can account for the fundamental issue at stake, which, for intellectualists, is the claim that "Kant strongly ties the exercise of intellectual cognitive capacities to the conditions governing the possibility of objective sensory experience" (McLear 2016, 183). The question then becomes more

[22] Note also that some also distinguish between strong and weak conceptualism, and essentialist/non-essentialist conceptualism, though these distinctions are not germane to the present discussion. *See*, *e.g.*, Hanna 2016, 101.

focused on the core issue of whether there are some “distinctively intellectual capacities” involved in perception (or “intuition”) (ibid., 184).

2. The Transcendental Deduction

a. The Structure of the Transcendental Deduction

Dieter Henrich, in a landmark paper described by Allison as “set[ting] the agenda for all subsequent work on the B-Deduction” (2004, 160), argued that Kant set forth a “two-steps-in-one-proof” formulation of the Transcendental Deduction, that is, that Kant presented one argument with two steps (Henrich 1969, 642). According to Henrich, the first step of Kant’s proof is to show that the categories unite a manifold of intuition; the second step is to establish that the categories are valid *a priori* for all objects of experience. *See* Henrich 1969, 642, 645, 646. Allison notes that while Henrich’s argument that Kant is making a two-step proof in the Transcendental Deduction has been “widely accepted,” there is not a consensus about what those specific steps are (2004, 161). Allais corroborates this lack of consensus; she argues that “[t]here is no agreement on what conclusion the argument [in the Transcendental Deduction] aims to establish, never mind what the premises or argumentative structure are supposed to be” (2022, 71). Rather, she maintains, “we are liable to go astray if we attempt to find careful order, assuming that different stages of the argument as presented in the text must build on each other in a neat, structured sequence” (ibid.). Thus, while Henrich’s article is undoubtedly influential, it is not universally accepted. The interpretation presented here is closer to Henrich’s in that it interprets Kant as moving from a transcendental framework (i.e., apperception) to its application to empirical sensibility (i.e., apprehension). That said, there is utility in interpreting the Transcendental Deduction's earlier sections in light of its later ones in attempting to ascertain the structure and content of Kant's proof, which is consistent with Allais's exhortation that we should exhibit some flexibility in how we parse Kant's arguments.

b. Establishing a Working Understanding of the Categories

While a detailed elaboration of the categories will occur below in chapter three, a working understanding of the categories is essential background for what follows here; so we must begin with a brief explanation of the categories and issue a promissory note for further discussion.

In the part of the first *Critique* called the Analytic of Concepts, Kant argues that if we "abstract from all content of a judgment in general[] and attend only to the mere form of the understanding in it," we can discern four functions: (1) quantity; (2) quality; (3) relation; and (4) modality (B 95). Each function may be thought of as a category containing related but distinct types ("moments"). For example, the third function, "relation," concerns "the relations of thinking in judgments" (B 98). Kant gives three types of judgments under the "relation" function: categorical, hypothetical, and disjunctive. *See* B 95. A categorical judgment relates to subject/predicates; a hypothetical judgment pertains to grounds and consequents; and a disjunctive judgment is "logical opposition between propositions (B 98-99).

Kant later asserts that there are "exactly as many pure concepts of the understanding, which apply to objects of intuition in general *a priori*, as there were logical functions of possible judgments . . .." (B 105). Accordingly, the pure concepts of the understanding are subdivided into the following classes: (1)

quantity; (2) quality; (3) relation; and (4) modality (B 106, 110). Kant explains that quantity and quality are "concerned with objects of intuition," while relation and modality are "directed at the existence of these objects (either in relation to each other or to the understanding)" (B 110). To stick with "relation" as an exemplar: the class of "relation" contains within it three "categories" (or "pure concepts"), i.e., inherence/substance (substance and accident), causality/dependence (cause and effect), and community (reciprocal causation, where one thing does not "determine [the] other **unilaterally**, as in a series," but, rather, two things influence each other) (B 106, 110-12). As will be explained more fully below, these pure concepts are the *a priori* conditions of the possibility of experience (B 126); that is, they provide the "form for ordering" "matter" (content) obtained through the senses (B 118). With this working definition for "pure concepts" in hand, we may return to the question of how, generally speaking, the categories interact with intuitions to constitute experience.

c. *Escaping the Terminological Labyrinth: On Representations, Sense Impressions, and Intuitions*

Kant begins the Transcendental Deduction by drawing a distinction between the "manifold of representations . . . given in an intuition that is merely sensible [and] without being anything other than the way in which the subject is affected" and the "**combination** . . . of a manifold in general [that] can never come to us through the senses, and therefore cannot already be contained in the pure form of sensible intuition; for it is an act of spontaneity . . . [which] one must call . . . understanding." (B 129 - 130). Note that, for Kant, the "understanding" is a faculty of cognition and may generally include reason, understanding (narrowly construed), and judgment. Gomes explains this tripartite distinction as follows: Kant defines reason as being our ability to apply *a priori* concepts to objects irrespective of whether they are objects of experience; the understanding "in the strict sense deals only with what is or can be given in sensibility," and judgment is our ability to "subsume under rules" (2017, 7).

The opening lines at B 129-30 suggest a distinction between the "manifold of representations . . . given in an intuition" and the combination of the manifold. I suggest that the former (*i.e.*, a manifold of representations) consists of a variety of sensible representations (viz., sensible material akin to sense impressions) and the latter (combination) is an organization of that sensible material by our understanding. In other words, on the view presented here, Kant refers to the manifold of intuition as sensory input which the understanding combines into a representation. This is consistent with McDowell, for example, who seems to equate intuitions with being "impressions themselves, impingements by the world on our sensibility" (1996, 10);[23] *see also* McDowell 2009, 95 (noting that Kant uses "intuition" in the Transcendental Deduction to refer to "episodes of sensory receptivity already structured by the understanding"); Ameriks 2015, 553 (describing "sensible representations" as being "mere impressions, scattered in an unintelligible 'multiplicity' or *manifold*; in Kant's words, 'thoughts without content are empty, intuitions without concepts are blind'"); Grüne 2017, 80

[23] However, McDowell maintains that those impressions "are already equipped with conceptual content" and inseparable from conceptual structuring (1996, 34).

("[S]ensations constitute sensible objective representations only if they are synthesized by the understanding and if the categories function as rules for such a synthesis[; and] if the categories function as rules for sensible synthesis, then the object of such a representation, if it existed, would fall under the categories . . .."); Horstmann 2018, 19 fn. 15 (noting that Kant uses "sensation" and "impression" "quite often interchangeably"); ibid., 14 (conceding it "looks as if" the understanding "turn[s] a given manifold of sensible *representations* into intuitions of objects . . . governed by rules," *i.e.*, the categories) (emphasis added); Meerbote 1990, 168 (noting that Kant calls sensations "representations").

Let's examine first some textual evidence for the claim that an intuition is a singular representation of an object that contains within it a manifold of sense impressions. In the Transcendental Deduction, Kant states:

> There is thus an active faculty of the synthesis of this manifold in us, which we call imagination, and whose action exercised immediately upon perceptions I call *apprehension*. For the imagination is to bring the manifold of intuition into an **image**; it must therefore antecedently take up the *impressions* into its activity, *i.e.*, apprehend them.

A 120-21 (footnote omitted; italics added). In other places in the first *Critique*, Kant refers to "the impressions of the senses" being the "**matter** for cognition from the senses" (B 118); and he describes one "fundamental source[]" of cognition as being the "reception of representations (the receptivity of impressions)" (B 74).

Consistent with this, Sellars observes that "Kant clearly commits himself to the view that some representations of individuals are intuitions and *yet* involve a 'synthesis' which, if not a function of the understanding in its role of subsuming representations under general concepts, is certainly no matter of sheer receptivity, but rather of that interesting meeting ground of receptivity with spontaneity which is the 'productive imagination'" (1967a, 4). We will return to the subject of the productive imagination below; the important thing for present purposes is to note Sellars' observation that, for Kant, there are intuitions that are singular representations of objects which are nonetheless products of a synthesis by the understanding, which is the view argued for here. Thus, "intuition" is a stand-in for a singular "representation." *See, e.g.*, Grüne 2016, 91 (noting that "Kant defines intuitions as singular representations that have an immediate relation to an object") (citing B 376-77); Land 2016, 146 (also noting that intuitions are, for Kant, "singular representations of objects").

Note, however, that Grüne later expressly observes that Kant employs the term "intuition" in two ways in the first *Critique*, *i.e.*, to refer to a "manifold of unsynthesized sensations" and then, alternatively, as "conscious singular representations that relate immediately to objects and thus are intentional states [that] presuppose sensible synthesis" (2022, 98). Others have made observations consistent with this: Allison, for example, discerns some ambiguity in how Kant employs the term "intuition," and identifies three different senses of it (2004, 82). So, "intuition" bears at least two meanings.

Thus, there is support for the notion that Kant takes singular representations to be composed of sensory material organized by the mind, though the term "intuition" is used ambiguously. Accordingly, when Kant refers to the unity of a manifold of intuition, we may interpret him as meaning the unity of a manifold of sensory impressions; and when he speaks of one "empirical intuition," or intuition of an object, we may interpret him in the more conventional sense of a singular representation of an object.[24] But what remains opaque, at this point, is the difference between a manifold and the combination of the manifold.

Kant uses the German world *das Mannigfaltige*, which, literally translated is "manifold"—but our understanding of what "manifold" means can be enriched by turning to other definitions of the term *das Mannigfaltige* and the related *die Mannigfaltigkeit*. *Mannigfaltig*, as an adjective, is defined as "various, manifold, diverse, multifarious," and the noun *die Mannigfaltigkeit* is defined as "multiplicity, variety, diversity."[25] So we might well consider *das Mannigfaltige* not just in light of its more literal—but also opaquer—translation, "manifold," but also in view of its related definitions, including "variety" or "diversity." A substitution of "variety" for "manifold" instantly clarifies the passage: we receive through sensibility a variety of representations in an intuition—but the combination of that variety occurs *via* the understanding.[26] This is helpful; but what it still leaves unclear is what the nature of combination.

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[24] This is *contra* Allais who asserts that, for Kant, "intuitions are not sensations" (2017, 32), and that "[t]o say that we have a manifold of intuitions that must be synthesized does not mean that we do not have intuitions ([*i.e.*,] that we have a mass of unorganized sensations)[;] [o]n the contrary . . ." (ibid, 38-39). This is also in opposition to Allais' argument that "synthes[i]s is something done to intuition not something that produces intuition," and, therefore, synthesis does not produce intuitions (2022, 74).

[25] Cassell's German Dictionary 406 (2002). Houghton Mifflin Harcourt Publishing Company.

[26] This conclusion is not without controversy; as Gomes notes, the question of whether the "understanding is operative in the generation of intuitions . . . is an issue which divides recent commentary on Kant" (2017, 8).

Kant provides clarification in short order. What the understanding combines is sensory material into representations of external objects, *i.e.*, intuitions:

> [A]ll combination, whether we are conscious of it or not, whether it is a combination of the manifold [or variety] of intuition or of several concepts, and in the first case either of sensible or non-sensible intuition, is an action of the understanding, which we would designate with the general title **synthesis** in order at the same time to draw attention to the fact that *we can represent nothing as combined in the object without having previously combined it ourselves*, and that among all representations **combination** is the only one that is not given through objects but can be executed only by the subject itself, since it is an act of its self-activity (B 130) (emphasis added).

There are several remarkable things about this passage. The first is that "combination"—regardless of whether the thing combined is sensible or non-sensible intuition—is an action of the understanding, which Kant terms "synthesis." So "synthesis" is, among other things, the understanding's combination of sensible intuitions "in the object."[27] While the combination of a manifold of intuition *in* an object is a peculiar turn of phrase, the foregoing shows, that combination results in the formation of representations of objects.[28]

Kant calls "the determinate relation of given representations to an object" our "faculty of cognitions"—in other words, cognition is a subject's act of

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[27] "Combination" is a translation of *Verbindung*. The verb *verbinden* means to "unite, join, combine…connect (with *or* to), bind, link . . .." Cassell's German Dictionary 659. *Die Verbindung* accordingly means the "binding, joining, connecting; blending, combination; union" (ibid.).

[28] The mind unites our variety of intuitions into objects pursuant to concepts (B 137). *See, e.g.*, Kant's assertion that "[a]n **object**, however, is that in the concept of which the manifold of a given intuition is **united**" (B 137). *See also* Horstmann 2018, 15 (noting that an object, for Kant, is a "unity of a manifold [that is] . . . the result of a conceptual operation . . ..").

combining representations and relating them to objects of representation (B 137).[29] Thus, the Transcendental Deduction ultimately concludes that the combination of sensory representations— that is, a manifold of sensible intuition—by a subject into a representation of an external object is a cognitive act. Stated otherwise, our representations of external objects are products of our "self-activity," namely, our union of sensory information into representations of external objects, which we perform according to the categories, or the pure concepts of the understanding.[30] The following shows this:

> *Combination does not lie in the objects, however, and cannot as it were be borrowed from them through perception and by that means first taken up into the understanding*, but it is rather only an operation of the understanding, which is itself nothing further than the faculty of combining *a priori* and bringing the manifold of given representations under unity of apperception, which principle is the supreme one in the whole of human cognition (B 134 – 135) (emphasis added).

[29] Kant shortly thereafter refers to the "relation of representations to an object*" as "*validity…." (B 137).

[30] *Contra* Allais, who maintains that combination does not refer to the synthesis of sensory material into intuitions (*i.e.* singular representations of particular objects), but rather the "manifold of presentations of singular things [*i.e.*, intuitions,] that needs to be gone through, taken up, and combined" for the purpose of cognition of the "objects presented in intuition" (2017, 41); *cf.* Horstmann 2018, 43 (observing that "[t]here is an ambiguity in Kant's use of the term 'manifold of intuition,'" in that Kant sometimes refers to "the manifold of perceptions out of which a single *intuition* is formed," and at other times to "the manifold aspects that a single *object* can have when given 'in intuition'").

This shows that while our representations of objects are unified, the union does not derive from the objects themselves, but, rather, the understanding, which takes a manifold of sensory material up and organizes it.[31,32]

The foregoing shows that, for Kant, our formation of representations of external objects (via combination of a manifold of intuition) is a cognitive act, that is, a product of our understanding.

d. Cognition and Perception

For Kant, "cognition" is the "determinate relation of given representations to an object" (B 137); in other words, it is a mental representation formed by a subject through its combination of sensory information, which, further, has an external referent. There are different interpretations, however, of what

[31] Allais concedes that "[a]n argument for thinking Kant is a conceptualist about intuition could be based on thinking that he holds synthesis to be necessary for us to have presentations of unified particulars," however, she maintains, for the pure intuition of space, our representation of space as a unity precedes representations of its parts, and, accordingly, synthesis is not necessary for all kinds of intuitional unity (2017, 33). This is ostensibly based on Kant's discussion of our pure intuitions of space/time as discussed in the Transcendental Aesthetic. *See*, *e.g.*, Allais 2016, 25 (arguing that the Transcendental Aesthetic is evidence against intellectualism). However, the possibility that the pure intuitions of space and time do not need to be synthesized by the understanding, as suggested in the Transcendental Aesthetic, has no bearing on whether the understanding unites sensory material into *empirical* intuitions.

[32] Kant uses the label "transcendental unity of self-consciousness" to refer to a subject's capacity to recognize that its representations are contained in "one and the same" consciousness (B 132). This self-consciousness derives from what Kant calls "pure apperception" (or "original apperception") (B 132). Kant further distinguishes between "synthetic" and "analytical" unity of apperception: synthetic unity of apperception is the combination of a variety of representations in one consciousness; and this makes possible the analytical unity of apperception, namely, the "identity of the consciousness in these representations itself" (B 133).

constitutes cognition for Kant. McLear notes that Kant uses "cognition" in a broad and a narrow sense (2016, 5). The broad sense refers merely to conscious representations of objects (ibid.) (citing, *inter alia*, B 103); the narrow sense refers to the product of "a synthesis of concepts and an intuited manifold," and, accordingly, would have three characteristics: (1) consciousness; (2) truth-aptness; and (3) "real possibility" (that is being a "metaphysically [] possible subject matter") (ibid., 6); *see also* McLear 2021, 5 (articulating the distinction as follows: the wider sense includes "a conscious representation of an object," and the narrower sense is a "state[] that [is] the outcome of a synthesis of concepts and an intuited manifold"). As Horstmann puts it, a "cognitive object" is a "representation of an item that (1) is the result of a conceptual determination of some set of data in accordance with the categories and that (2) can be integrated into a spatiotemporal framework" (2018, 8).

Also helpful for discerning the nature of "cognition" are what Kant terms the "supreme principle[s] of all intuition" (B 136). Kant presents two supreme principles of intuition: the first is that, *vis-à-vis* sensibility, "all the [variety] of sensibility stand under the formal conditions of space and time" (B 136). The second supreme principle of all intuition, *vis-à-vis* understanding, is that "all the [variety] of intuitions stand under conditions of the original synthetic unity of apperception" (ibid.). Our intuitions "stand under the first principle insofar as they are **given** to us, and under the second insofar as they must be capable of being **combined** in one consciousness…" (B 136-37). These two principles make cognition possible.[33] (Kant's reference to apperception serves as a reminder that, for the moment, Kant's argument is a transcendental one and its empirical application, if any, is yet to be determined. *See* B 132 (Kant defining apperception and distinguishing it from empirical representations).)

To reiterate: cognitions are the "determinate relation of given representations to an object" (B 137). Elsewhere, Kant notes that "[u]nderstanding is, generally speaking, the faculty of cognitions" (B 137), though one can legitimately translate the same as: "mind is, generally speaking, cognitive ability."[34] So the understanding is the faculty of cognitions, and cognitions are the mind's relation of its representations of objects to the objects of representation. Consistent with this, Kant defines "objective validity" as the "relation of representations to an object," which makes these representations "cognitions" (*ibid.*). *Accord* Heidemann (2023, 32) (arguing that Kant is a proponent of mental content externalism, *i.e.*, that our representations depend on sensory input, and that "external objects are accessible to cognition as the real external causes of our perceptual beliefs about the world . . ..)

Kant next provides a crucial example. He states:

> [I]n order to cognize something in space, e.g., a line, I must **draw** it, and thus synthetically bring about a determinate combination of the given [variety], so that the unity of this action is at the same time the unity of consciousness..., and thereby is an object...first cognized (B 137-38).

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[33] Note that the first supreme principle, concerning the formal conditions of space and time, pertains to the Transcendental Aesthetic.

[34] "*Verstand ist, allgemein zu reden, das Vermögen der Erkenntnisse.*" *Verstand* may denote "mind, intellect, intelligence," and *Vermögen* can also denote "ability, capacity, power," with "ability" being arguably more literal than "faculty." Cassell's German Dictionary 673, 681.

This reveals that the cognition of an object in space, that is, the formation of a mental representation related to an external object, is the result of the mind's combination of a manifold of intuition into the representation of the object.[35] Further, the unity of consciousness is established because there must be one consciousness in which the intuitions are united.

Two issues arise here. One—which we must briefly set aside— is Kant's introduction of the idea of an "empirical intuition," which is notable because, so far, we have been analyzing a transcendental framework. Another issue, which we presently address, is the question of why we should take mental representations (that have some connection to external objects) to be "cognition." We saw above that Kant reserves the term "cognition" for just this sort of representation; this clarifies the terminology, but it does not resolve the substantive issue of why we should take a representation that has some relation to an extrinsic object to be a "cognitive" act, unless we define "cognition" to be "any sort of action performed, or product composed, by the mind," in which case, the argument could be accused of circularity.

But we need not find Kant guilty of circular reasoning. "Cognition" is more than a term of art for Kant; its deployment is justified for the following reasons: according to Kant, the mind's combination of a manifold of intuition into a cognition—*i.e.*, a representation of an object related to an external object of

[35] Onof similarly observes that a subject unites representations according to *a priori* concepts, *i.e.*, the categories, and, therefore, "cognising an object for Kant involves having conceptual representations that relate to the object…" (2016, 201).

representation— occurs pursuant to the categories, or what he alternatively calls the "logical functions for judgment": Kant argues that the specific "action of the understanding" through which a manifold of intuition is "given in **one** empirical intuition is **determined** in regard to one of the logical functions for judgment, by means of which . . . it is brought to a consciousness in general," and the categories are these functions for judging (B 143). Consequently, "the [variety] in a given intuition also *necessarily* stands under categories" (ibid.) (emphasis added).

Apart from his assertion that the combination of a diversity of intuitions occurs pursuant to the categories, we see that Kant, in other places, also maintains there is a close relationship between the mind's act of forming cognitions and its act of judging. He asserts that "a judgment is nothing other than the way to bring given cognitions to the **objective** unity of apperception," *i.e.*, to "distinguish the objective unity of given representations from the subjective" (B 141-42). Recall that a cognition is a representation that has an external (hence "objective") referent, *i.e.*, an object. Kant further clarifies that a judgment denotes "a relation that is **objectively valid**" (B 142), meaning, in other, arguably simpler terms, that "representations are combined in the object . . . 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)" (B 142), as is the case with subjectively valid relations. So, it follows that whenever we discern a relation between our cognitions that we take to be objectively valid, we have made a judgment (namely that there is some relation between our representations independent of how the subject is positioned).[36] Our ability to discern that our representations are united objectively, rather than subjectively, is, in a sense, judgment, and, thereby, normative.[37]

We seem, here, to be approaching something like McDowell's view, *i.e.*, that perception is judgment because it reflects a sensitivity to the fact that the world is something independent of how a subject is situated. In *Mind and World*, for example, McDowell asserts that, "[h]ow one's experience represents things to be is not under one's control," and that it must reflect "a sensitivity to a kind of state of affairs in the world, something that can obtain independently of those perturbations in her stream of consciousness" (1995, 11, 12). That said, recall that Kant's argument, so far, is a transcendental one, and, therefore, we must establish that the next step in Kant's argument is to demonstrate that the understanding actually uses the categories to synthesize a manifold of empirical

[36] The view presented here—*i.e.*, that cognition is a term of art for the representation of an external object—is not without detractors. For example, Allais argues that intuitions do not require "conceptual structuring" to present consciousness with objects; and the "objective validity" our representations have occurs by virtue of intuitions alone (2016, 14, 21-22.). See also McLear 2016, 194-95 (advocating for sensibilism, according to which intuitions, without any "exercise of intellectual cognitive capacities," present objects to a subject).

[37] Land argues for what he calls "moderate conceptualism," according to which the human mind synthesizes spatiotemporal sensory input into representations of objects, but that this ordering is distinct from judgment because judgment is predicative, whereas synthesis, as mentioned, is spatiotemporal (2016, 148-49). However, equating judgment simply with predication does not reflect the different sorts of judgments Kant delineates, including, but not limited to, predication. See B 95-99. Note, also, that the claim that normativity is implicated here is not unprecedented. *See* Onof (2016, 226).

sense impressions into representations of objects.[38] That said, there are indicia that Kant intends the argument to move in this direction.

Kant provides that, in a later section of the *Critique*, he will show that empirical intuitions are formed in accordance with the transcendental framework he has already established:

> In the sequel (§ 26) it will be shown from the way in which the empirical intuition is given in sensibility that its unity can be none other than the one the category prescribes to the manifold of a given intuition in general . . .; thus by the explanation of its a *priori* validity in regard to all objects of our senses[,] the aim of the deduction will first be *fully attained* (B 145) (emphasis added).

Kant thus explains that the *a priori* conditions of cognition govern empirical intuition, and this is the whole "aim" of the Transcendental Deduction.

Kant distinguishes between pure intuition (space and time) and empirical intuition. Empirical intuitions are those that are represented "as real in space and time"; however, "**[t]hings in space** and **time**…are only given insofar as they are perceptions (representations accompanied with sensation), hence through empirical representation" (B 147). Thus, an empirical intuition is the representation of something as real in space and time; and representations "accompanied with sensation" are perceptions, or "empirical representations" (ibid.); *accord* Grüne 2022, 91 n.3 (noting, "That Kant's use of 'empirical intuition' at least includes *a* use that corresponds to our use of 'perception' is accepted by most Kant scholars . . ..") *and* Land 2016, 154 ("What seems clear is that Kant uses 'perception' (*Wahrnemung*) to refer to what, without begging the question, can be described as the combination of empirical intuition and

[38] *See, e.g.,* B 132.

consciousness . . ..”). Thus, we can proceed with an understanding that, for Kant, an empirical intuition can correspond to our contemporary term “perception.”[39]

Additionally, Kant further asserts that the application of the categories to empirical intuition makes possible “empirical cognition,” or “experience” (B 147). *Accord* Horstmann (2018, 10) (noting that “Kant defines experience as empirical cognition”); *see also* Grüne 2022, 101 (noting that Kant uses “experience” in two ways, one of which includes “every objective, conscious,

[39] This, however, is complicated by the fact that Kant uses the word “perception” in several ways. As Horstmann notes, in the A-deduction, in particular, Kant refers to a perception as the “ultimate building blocks of intuitions, *i.e.*, conscious sensations “ (2018, 50) (citing A120, A225, B 272), but that in the B-deduction, “it is introduced in order to refer to the empirical consciousness of an intuition” (ibid.) (citing B160). *Cf.* McLear 2021, 9 (conceding there is “at least some evidence” to support the claim that Kant takes “‘perception’ (*Wahrnemung*) . . . [to] constitutively involve[] concepts or otherwise depend[] on conceptual synthesis”). Further, passages such B 160, 164-165, in which Kant equates “perception” with things that “reach empirical consciousness” suggest that perception and empirical consciousness are the same. Gomes notes that, for Kant, perception (*Wahrnehmung*) “is something like an intuition of which one is conscious” (2017, 17) (citing Kant’s *Prolegomena*, 4: 300).

McLear provides a taxonomy according to which intuitions are the “most basic object-related representation” (2021, 11), which the imagination combines into perceptions (ibid., 8), which a subject further combines pursuant to the categories, constituting experience (ibid.). However, Horstmann provides an alternative account: the imagination transforms sensations which are “physiological events” into perceptions (i.e., “content-filled representations” such as colors and shapes); and perceptions are thereafter synthesized into intuitions (ibid., 31). Following this, Horstmann argues the imagination then constructs representations of objects out of intuitions (ibid., 45). So, we see here two different accounts Kant’s hierarchy of representations. An important takeaway from this point is that, as with other terms, such as “intuition,” Kant uses “perception” in different ways, and different commentators have emphasized different interpretations.

empirical representation").[40] While this is something of a terminological labyrinth, we must recall that—as argued above—a cognition is a representation that has an external referent; and (sensible) intuitions are just sensory representations. So an empirical cognition—that is, a representation with an external referent, that is accompanied by sensations, which the understanding has united according to the categories—is also called "experience." Thus, while Kant admittedly uses various terms in different senses, there are uses according to which an empirical intuition is an empirical representation; conscious empirical representations constitute experience; and experience is empirical cognition. So while each term has a specific denotation, there is something of a venn diagram where each term has substantial overlap with the others.[41]

As noted above, section twenty-six of the Transcendental Deduction is the lynchpin for the application of Kant's transcendental framework to experience. There, he explains that his aim is to demonstrate the "possibility of cognizing *a priori* **through categories** whatever objects **may come before our senses**…a far as the laws of their [i.e., intuitions'] combination are concerned" (B 159). Kant begins by defining the "synthesis of apprehension" as the

[40] *But see* Allais (2016, 4) who argues, conversely, that "phenomenological consciousness" of objects is distinct from "experience" or "empirical cognition," and, accordingly, the former requires only intuitions (ibid.).

[41] We need not approach the taxonomy of terms Kant gives at B 376 with rigidity. Horstmann notes that we could attribute to Kant an "embarrassing recklessness" arising from his inconsistent terminology (2018, 53), and, in the end, each interpreter might always find a passage that undermines another passage. This need not preclude us from attempting to give a systematic and consistent interpretation of Kant's views.

"composition of the manifold in an empirical intuition, through which perception, i.e., empirical consciousness of it…becomes possible" (B 160). The synthesis of apprehension "can be none other than that of the combination of the manifold of a given **intuition in general** in an original consciousness, in agreement with the categories, only applied to our **sensible intuition**" (B 161). In other words, the synthesis of apprehension, which constitutes perception/experience, is none other than the empirical instantiation of the transcendental synthesis of apperception.[42] Kant explains as much. *See* B 162 fn.[43]

The foregoing further implies that Kant's account of perception is integral to, and inseverable from, his transcendental idealism, specifically, his Copernican

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[42] This position is similar to one which Grüne argues for, namely, that a synthesis of sensible representations "is required for transforming the qualitative and the spatiotemporal content of complex sensible representations into intentional content and making this content phenomenally present to the subject" (2016, 88 n.4).

[43] It bears noting that even in the Transcendental Deduction, there are sections seemingly at odds with the interpretation presented here, specifically at B 122, where Kant states, "The categories of the understanding, on the contrary, do not represent to us the conditions under which objects are given in intuition at all, hence objects can indeed appear to us without necessarily having to be related to functions of the understanding, and therefore without the understanding containing their *a priori* conditions" (B 122). A *prima facie* reading of this passage, which is contradictory to the view advanced here, is that, for Kant, we may have intuitions of objects without the categories combining the intuitions into representations. Allais, for example, reads the passage this way (2017, 35).

One way to reconcile this passage with the view advocated for herein is to argue that, in it, "Kant formulates a possibility he ultimately means to reject . . ." (Guyer and Wood 1998, 222 n.17). Others note that Kant, here, "is evoking a *logical* possibility of objects appearing to us [as such]," though the project of the Transcendental Deduction is to show that this possibility is not in fact realized. *See* Onof 2016, 209-210.

revolution, according to which we are able to ascertain necessary truths about the world because they derive from how the human mind necessarily functions.[44] As was shown above, the categories are concepts that govern how the mind combines sensory impressions into representations, including cognitions. But, of those same categories, Kant asserts: "[They] prescribe laws *a priori* to appearances, thus to nature, as the sum total of all appearances" (B 163), in which case, the question "arises how it is to be conceived that nature must follow them, *i.e.*, how they can determine *a priori* the combination of the manifold of nature without deriving from the latter" (*ibid.*). Stated otherwise, the same categories that prescribe how mental representations relate to each other also prescribe, *a priori*, the laws governing the natural world. This is the case because these laws "exist only relative to the subject in which the appearances [i.e., representations of the world] inhere, insofar as it has understanding, as appearances do not exist in themselves, but only relative to the same being, insofar as it has senses" (B 164). These representations "*stand under no law of connection at all except that which the connecting faculty prescribes*" (ibid.) (emphasis added).[45]

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[44] Accordingly, this interpretation of Kant is premised on his transcendental project and therefore must reject claims that Kant's conceptualism or nonconceptualism does not "depend[] directly upon one's stance on transcendental idealism" (Golob 2016, 32-33).

[45] It is worth noting that Grüne not only distinguishes between empirical concepts and pure concepts (categories), but further argues that Kant distinguished between clear and obscure concepts, and that the concepts required for sensible synthesis are "obscure categories" (2022, 112-13). There are at least three difficulties with this proposal as I understand it: (1) Grüne acknowledges that "it is fundamentally less clear what exactly [Kant] understands by obscure concepts," as contrasted with clear concepts (*ibid.*, 103); (2) obscure concepts are

e. Is (Empirical) Cognition Object-Dependent?

Gomes and Stephenson note there are different views about the relation between intuition and objects of intuition, including the "object dependent" view and the "object independent view" (2016, 65). According to the object-dependent view, objects of cognition must exist for there to be corresponding intuitions (*ibid.*), whereas, for the object-independent view, cognition is a "representation which has objective purport," meaning it represents "a state of affairs as obtaining" (ibid., 64). Where the two differ, according to Gomes and Stephenson, is that, on the object-independent view, objective purport does not require an "actual object" of representation, and thus, it permits the possibility of, for example, hallucination (*ibid.*, 65). Interestingly, "objective purport" describes how things appear to the subject (i.e., there appears to be an external referent for the representation), but it does not necessarily entail assent (viz., a belief that the object actual exists) (*ibid.*, 65, 66).

The range of views on this matter may be further subdivided into object-independence and strong- and weak-object dependence. Strong object-dependence is where an intuition necessitates that, at the time a subject has the intuition, there is an actually existing object of that intuition. *See*, *e.g.*, Grüne

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characterized so vaguely that they seem to have little substantive utility and are therefore philosophically uninteresting—as Grüne concedes, if intuitions are synthesized according to obscure categories, "it turns out that intuitions are not conceptual states in any interesting sense" (*ibid.*, 113); and (3) on the interpretation I give, turning to obscure categories is unnecessary, *contra* Grüne 2022, 102 (arguing for the necessity of turning to obscure categories to explain how Kant can maintain that intuitions precede concepts but concepts also precede intuitions) because the proposal I advance is that the categories are the "concepts" that operate in tandem with intuition.

2017, 67. Weak object-dependence is where an intuition requires that the object of the intuition exists at the time of the intuition, or, at least, at some previous time (*ibid*., 70). McLear provides a similar, if finer grained, tripartite distinction between strong-, moderate- and weak-presence dependence (2017, 89, 90, 93). McLear's strong- and moderate-presence dependence more or less correspond to Grüne's strong- and weak-object dependence. McLear's weak-presence dependence is satisfied if a subject intuits an object at the time of the intuition, or it previously existed and stood in an appropriate causal relation to the intuition, or some sensory qualities "characteristic of" the object existed at some previous time, from which the subject combined them to form the intuition (2017, 93).

McLear suggests that the intellectualist, even if able to distinguish between hallucination and perception, is still hard pressed to explain the contribution intuition makes to satisfying the modal condition of cognition, *i.e.*, that the object of cognition is objectively real (2016, 186-94). McLear later goes on to propose that outer intuitions are those that strongly depend on their objects, while "inner intuitions," *i.e.*, those generated by the imagination are different in kind (2017, 102). Accordingly, there is, for McLear, in principle, a way of distinguishing hallucination and perception. *But see* Stephenson 2017, 107-08 (arguing against views such as McLear's).

The view presented here is that cognition is object-dependent, and so intellectualism satisfies the modal condition because there must be an external referent for the cognition. This is not to say that another mental faculty, *e.g.*, the reproductive imagination, could not generate representations that have "objective purport" without being objectively valid, but instead subjectively valid.

See, *e.g.*, B 141-42 (discussing representations belonging to the understanding in contrast to those of the reproductive imagination).

The question might then arise how we distinguish between objectively and subjectively valid representations in those instances where they both have objective purport. While this appears to be a problem, it is chimerical unless it can be shown that, in everyday experience, we are always able to immediately distinguish objectively and subjectively valid representations with objective purport. After all, if we sometimes find ourselves in situations where we must analyze whether a representation is subjective or objective, then it is unreasonable for us to expect that Kant should proffer a theory where there is some invariant and inherent distinction between the two that always obtains. Instead, we might reasonably expect Kant to give some method for distinguishing between the two *when in doubt*.

Kant, in fact, presents a criterion for distinguishing the two, namely, an inquiry into whether the representations ultimately depend on some condition of the subject or obtain "regardless of any difference in the condition of the subject . . .." (B 142). However, the issue of how to distinguish between objectively and subjectively valid representations, when both have objective purport, is still unsettled. *See*, *e.g.*, Fish 2010, 98-104 (explaining the range of views about whether perceptions are distinguishable from hallucinations, and, if so, how). *Compare* Grüne 2017, 75 n.15 (arguing that intuitions formed by the imagination would, by virtue of the fact that they are intuitions, be "singular and immediate representations," but not object-dependent; in which case, the singularity and immediacy of an intuition cannot necessarily imply object-dependence) *and*

McLear 2017, 98 (noting that, for Kant, "[o]ne cannot always tell whether what one is experiencing is a genuine spatially extended object, or merely an inner ersatz sensory object generated by one's imagination"); *see also* B xli (Kant stating that "which given intuitions actually correspond to outer objects, which therefore belong to outer **sense** . . . rather than to the imagination – that must be decided in each particular case . . ..").[46]

f. A Role for the Imagination?

The emphasis in this chapter has been on the relation between the understanding and its combination of sensory material to form objectively valid intuitions, i.e., cognitions. But Kant refers to another cognitive faculty—he describes the "transcendental synthesis of the imagination" as being "an effect of the understanding on sensibility and its first application . . . to objects of the intuition that is possible for us" (B 152). Kant elaborates: "Now insofar as the imagination is spontaneity, I also occasionally call it the productive imagination…." (B 152) (italics added). In other words, imagination is spontaneity; and at various points, Kant equates spontaneity with the understanding (*see*, *e.g.*, B 150). Thus, the imagination is not necessarily something separate from the understanding, or mind, but is rather an ability the

[46] In the A-edition of the fourth Paralogism, Kant observes that "cognition of objects can be generated from perceptions, either through a mere play of imagination or by means of experience," and, accordingly we must be able to distinguish between "deceptive representations" (including "a semblance of the imagination (in dreams)" and "false step[s] of judgment (in the case of so-called sense-deceptions") and representations corresponding to external objects (A 376). The method Kant gives there from distinguishing deceptive representations from representations proper is to determine whether the representations are connected by empirical laws (ibid.).

mind has to synthesize sensory material. There is precedent for this view. *See*, *e.g.*, Sellars' observation that, for Kant, synthesis of intuition "if not a function of the understanding in its role of subsuming representations under general concepts, is certainly no matter of sheer receptivity, but rather of that interesting meeting ground of receptivity with spontaneity which is the 'productive imagination'" (1967a, 4). Sellars notes that for Kant, the productive imagination "is the understanding functioning in a special way" (ibid., 4).

The productive imagination must also be distinguished from the reproductive imagination "whose synthesis is subject solely to empirical laws, namely those of association, and that therefore contributes nothing to the explanation of the possibility of cognition a priori, and on that account belongs not in transcendental philosophy but in psychology" (B 152). Kant also describes the "imagination" as follows: "***Einbildungskraft*** *ist das Vermögen, einen Gegenstand auch ohne dessen Gegenwart in der Anschauung vorzustellen*" (B 151). That is, "**imagination** is the power to represent an object without its presence in view," or, more naturally, "imagination is the power to represent an object without it being present in one's visual field."[47] While Horstmann, for example, seeks for the imagination a contribution distinct from the understanding, he concedes that it appears that, for Kant, "synthesis and thus the power of imagination has to bring together a manifold of data according to the rules of the understanding . . . [such that] there is no independent use of the

[47] Note *der Anschauung* is related to the verb *anschauen*, which is defined as "to look at."

power of imagination in the process of object constitution, i.e.[,] that the power of imagination cannot but synthesize governed by conceptual rules" (2018, 13). Horstmann additionally notes that Kant treats the imagination different in the A-deduction compared to the B-deduction in that, in the latter, Kant "tries to devaluate or even blur the distinction between the power of imagination and the understanding . . .." (ibid., 26).

Notwithstanding the textual evidence that Kant took the productive imagination to be a function of the understanding, Horstmann poses the provocative question of why Kant would bother to distinguish between the understanding and the power of imagination if "they perform the same tasks under the same regulatory constraints on the same material provided by sensibility" (2018, 24). I am inclined to follow Sellars and accept that the imagination is the understanding functioning in particular way rather than some other cognitive faculty. However, Horstmann provides an interesting alternative account of the imagination according to which the imagination transforms sensations which are "physiological events" into perceptions (i.e., "content-filled representations" such as colors and shapes); and perceptions are thereafter synthesized into intuitions (ibid., 31). Following this, Horstmann argues the imagination then constructs representations of objects out of intuitions (ibid., 45). Nevertheless, I see no necessary reason—and Horstmann, as I read him, does not provide one—for distinguishing the productive imagination from the understanding.

3. Conclusion

In sum, necessity in the natural world can only be found in our representations of the natural world (not in the things "in themselves"); and the necessary connections between our representations of the world are subject to transcendental necessity, that is the laws of the categories. Thus, the categories are the foundation for necessity in the world as it appears to us. It is worth quoting in full the passage where Kant links these three domains (the natural world [appearances]; empirical representations; transcendental representations):

> Now since all possible perception depends on the synthesis of apprehension, but the latter itself, this empirical synthesis, depends on the transcendental one, thus on the categories, all possible perceptions, hence everything that can ever reach empirical consciousness, i.e., *all appearances of nature*, as far as their combination is concerned, *stand under the categories on which nature . . . depends, as the original ground of its necessary lawfulness* . . . (B 164-65) (emphasis added).

Kant explains that although the understanding cannot "prescribe to the appearance through mere categories *a priori* laws beyond those on which rests a **nature in general**, as lawfulness of appearances in space and time," and "[p]articular laws, because they concern empirically determined appearances, **cannot** be **completely derived** from the categories, [nevertheless,] they all stand under them" (B 165).

In other words, the particular laws governing the empirical world "stand under" the categories, but are not completely derivable therefrom; instead, "[e]xperience must be added in order to come to know particular laws **at all** . . ." (*ibid*.). This is in accordance with Kant's stipulation, in the *Metaphysical Foundations*, that science is a system of laws prescribing the operations of the empirical world with necessity, owing to its *a priori* foundation, namely, the categories. It is this *a priori* ground that provides empirical laws with a basis for laying claim to necessity; empirical laws' necessity claims are thereby justified.[48] The aim of this chapter has been to establish *that* the human mind synthesizes sensory information according to the categories, and to introduce the idea that the *a priori* rules of the understanding (*i.e.*, the categories) apply not just to human sensible intuitions (that is cognition, or, stated otherwise, objectively valid representations) but also to natural laws. Our next task, then, is to explain in further detail the rules that the categories prescribe for the combination of sensory information, and how those same rules serve as a ground for the necessary lawfulness of the natural world.

[48] Kant undeniably had the *Metaphysical Foundations* in mind when he published the second edition of the first *Critique*, given that he asserted in the first *Critique* that the table of categories therein "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 . . . of a planned speculative science, as I have elsewhere given proof" (B 109-10). Kant further includes an express reference to the *Metaphysical Foundations*. *See* B 110 n.

CHAPTER 3
A MODEL FOR SCIENCE: KANT'S METAPHYSICAL FOUNDATIONS OF PHYSICS

In 1785, Kant was known to be working "on his Metaphysics of Nature and on Physics" (Kuehn 2001, 301-02). As Kuehn explains, "Kant had to write this book because he believed that science required apodictic certainty" (ibid., 302). This accords with the thesis of chapter one above, namely, that in the first *Critique*, Kant was concerned with, *inter alia*, the justification of scientific knowledge. As argued above, Kant believed that any satisfactory response to Humean skepticism about the necessity of, for example, causality, could not rest on merely empirical principles, but required some element of necessity known *a priori*.[49]

Friedman traces the project of the *Metaphysical Foundations* back to Kant's response to the "hostile" reception, in some quarters, of the first edition of the first *Critique*; that is, Kant resolved to defend his transcendental idealism from charges of it being mere Berkeleyan idealism (2002, 176). Specifically, Kant sought to respond to this charge by showing that appearances, on his view, "are spatiotemporal objects of natural scientific knowledge and, accordingly, . . . the point of the *Critique* is to secure the *a priori* foundations of this type of knowledge rather than to reduce the external physical world to a play of subjective mental states" (ibid.). Ultimately, whether we situate the *Metaphysical Foundations* in context of a pre-existing concern on Kant's part to

[49] *See, e.g.*, Friedman 2017, 195 (asserting that Kant, in the first *Critique* had an "anti-Humean conception of necessary causal connections and necessary empirical causal laws").

address Humean skepticism, or Kant's desire, following publication of the first edition of the first *Critique*, to rebut charges of Berkeleyan idealism, the end-product remains the same: in the *Metaphysical Foundations*, Kant sought to demonstrate the *a priori* foundation of scientific knowledge.[50] What this suggests, and what will be demonstrated further below, is that there is a tight link between the prescriptions and aim of the first *Critique* and the *Metaphysical*

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[50] This is not a universally accepted gloss on Kant's goal. Ameriks, for example, argues that Kant desired not so much to partake in a "battle" with skepticism or to provide an apology for Newtonian science, but, rather, to establish, on philosophical grounds, a nexus between the "manifest" and "scientific" images (2001, 33). As Ameriks summarizes his position, Kant wanted to "articulate the philosophical principles they[, *i.e.*, the ordinary realm of macro objects and the domain of theoretical entities,] need to share in order to be jointly understandable and acceptable" (ibid., 34). (Ameriks' use of the terms "manifest" and "scientific" images derives from Sellars' essay "Philosophy and the Scientific Image of Man" (Sellars 1991)). Ameriks' hypothesis is provocative, especially as it gives rise to questions such as whether Kant, in rejecting psychology, chemistry, and biology as proper sciences, merely meant to indicate that these domains are incommensurate with, *inter alia*, physics (2001, 35). The issue of translation between domains of laws is an interesting one in the philosophy of science. Fodor, for example, discusses the challenges in discerning "bridge laws" linking the laws of one domain to another (2007).

However, Kant repeatedly expressed his goal as showing that the laws of nature hold with necessity, which is why he believed they needed to be tied in with the *a priori* rules of the understanding. *Accord* Watkins 2001, 137 (stating that, for Kant, Newton's laws are "in need of justification in order to qualify for [their] status a scientific knowledge"). The issue of what constitutes a law does not depend on commensurability between domains so much as whether the system of purported laws rests on *a priori* grounds which make possible the laws' claims to necessity. This is not to say that Kant holds that we should not seek a unified body of scientific knowledge, but, instead, this is more the domain of the regulative use of reason, which aspires to unite various laws together as a unified system, and thus provides heuristics for the development of scientific hypothesis and laws. *See*, *e.g.*, Guyer 2006, 165-72; Friedman 1992, 48-49, 255-256. To be sure, the regulative use of reason seeks unity among different scientific laws, but that is distinct from the issue of whether, as a criterion for what constitutes a science, the laws of every scientific domain grounded in *a priori* laws must be translatable into the laws of another scientific domain because they have the same transcendental grounds.

Foundations, the latter of which applies the former's prescriptions and furthers its aims. Butts, for example, has argued that Kant's first *Critique* was supposed to provide, *via* the categories, a "general metaphysics," or a "schema of a complete *a priori* science," the instantiation of which, in physical objects, is to be found in the *Metaphysical Foundations* (1986a, 13). Butts concludes that the *Metaphysical Foundations* "is the completion of [the first *Critique*]" (ibid., n.12). *See also* Friedman 1986, 26 (arguing that Newtonian physics is a "realization" of the general metaphysics from the first *Critique*, and that the *Metaphysical Foundations* is a "critical or metaphysical analysis" of Newtonian science).

Watkins and Stan note that, for Kant, natural science proper has three requirements: (1) it must be "systematically ordered," (2) pursuant to "rational principles," and it must be (3) "known *a priori* with apodictic certainty" (*i.e.*, *a priori* with necessity) (2023, 6-7).[51] These "strict conditions" require that natural science contain a "pure part on which the apodictic certainty that reason seeks can be based" (ibid., 7 (quoting 4: 469)). The "pure" part of natural science, from which it derives its apodictic certainty, "can come only from the universal laws of thought, which are ultimately based on the categories" (Kuehn 2001, 302). However, recall that the categories from the first *Critique* give only general transcendental metaphysical principles; the application of those general

[51] As one might expect, there are different formulations of what constitutes a natural science for Kant. Gouax discerns five criteria natural science must satisfy for Kant: (1) it must contain a combination of synthetic *a priori* principles or laws; (2) "all natural objects of a particular science must conform to the synthetic *a priori* principles which are the basis of the science"; (3) the science must have a systematic unity; (4) the science must be mathematizable; and (5) "empirical laws . . . derive their 'comparative universality' from objective observation and experimentation" (1972, 239).

metaphysical principles to empirical concepts results in the special metaphysics of nature contained in the *Metaphysical Foundations* (Watkins and Stan 2023, 7).[52]

Considering the *Metaphysical Foundations* "relies heavily on [Kant's] own epistemological views as developed in the first *Critique*" (Kuehn 2001, 304), the purpose of this chapter is to explicate the relation between the transcendental principles in the first *Critique* and the metaphysics of nature in the *Metaphysical Foundations*. This chapter will proceed as follows. Section one will explain Kant's views about what is required for "proper" natural science, namely that it must have—in addition to empirical concepts—an *a priori* and apodictic foundation, which the first *Critique* and *Metaphysical Foundations* provide. Section two will explore the relationship between the first *Critique's* categories and their corresponding principles of pure understanding (the Axioms of Intuition, Anticipations of Perception, Analogies of Experience, and Postulates of Empirical Thinking in General). Section three will examine how the categories and principles of pure understanding are applied in the four chapters of the *Metaphysical Foundations*. Section four will briefly examine Kant's post-Critical assertion that there is a "gap" in his Critical philosophy that threatens to undermine the *Metaphysical Foundations*, and will ultimately suggest that—regardless of how this "gap" is understood—from the perspective of the Critical-era Kant, the Critical system is complete, and, therefore, the "gap" issue may be

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[52] Based on Kant's prior assertions that cognition requires concepts and empirical intuitions, Guyer correctly reasons that "even the most systematic and apodictic natural science must begin from *something* empirical if it is to be more than the mere form of possible knowledge" (2006, 158).

bracketed for present purposes. The ultimate aim of this chapter is to show that the *Metaphysical Foundations* is indeed the instantiation, or realization, of the more general propaedeutic in the first *Critique*, and thus show that the *Metaphysical Foundations* serves as an exemplar and model for the development of other sciences, *i.e.*, that science proceeds with a secure metaphysical foundation by corresponding with the categories and principles of pure understanding.

1. "Proper" Natural Science

As Guyer notes, for Kant, natural science "derive[s] the legitimacy of this title only from its pure part," which stems from *a priori* principles (2006, 157-58) (citing 4: 469). More specifically:

> [T]he laws of [a systematic natural] science . . . are to be established [for Kant] by systematically determining the consequences of applying the *a priori* laws of nature established by the "Transcendental Analytic" to the empirical concept of matter as that which is moveable in space, the structure of which is in turn established *a priori* by the "Transcendental Aesthetic" (Guyer 2006, 163).

Stated otherwise, the "pure part" of physics is elucidation of the "transcendental conditions of the cognition of matter in an *a priori* manner" (Carrier 2001, 117). Thus, there is a crucial relationship between the first *Critique* and the *Metaphysical Foundations*.

In the first *Critique*, Kant asserts that the table of categories is "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 . . ." (B 109). That is, the table of categories provides a framework for a system of science.

A brief segue is in order. While the present section seeks to elucidate the general relationship between the *a priori* principles in the first *Critique* and the scientific laws Kant sets forth in the *Metaphysical Foundations*, we should have some idea of what a science (and a system of science) is. Kant sets forth a taxonomy in the preface to the *Metaphysical Foundations*.

Kant begins with "nature," as the "whole of all appearances," or the entirety of the "sensible world," which may be divided into objects of outer sense and objects of inner sense, *i.e.*, the doctrine of body and doctrine of the soul, respectively, where the former considers extended nature, and the latter considers thinking nature (4: 467). A system of science is a "whole of cognition ordered according to principles," and while those principles may be either empirical or rational (ibid.), "the word *nature*," in any event, requires "cognition through reason of the interconnection of natural things, insofar as this cognition is to deserve the name of a science." What Kant calls the "historical doctrine of natural science" consists of "systematically ordered facts about natural things" (*i.e.*, classification and natural history), whereas natural science is susceptible to yet further subdivision (4: 468).

Natural science may be "either *properly* or *improperly* so-called" when it deals with its objects "wholly according to *a priori* principles" or, alternatively, according to the "laws of experience" (4: 468). Proper natural science, owing to its *a priori* principles, has apodictic certainty, whereas cognition that rests on "empirical certainty" confers knowledge "improperly so-called" (ibid.). Chemistry, Kant explains, is not a proper science because its facts are the result of "mere laws of experience," and accordingly, it exhibits no necessity (ibid.).[53] Kant explains in the first *Critique* that empirical laws, to the extent they have necessity, have "at least the presumption of determination by grounds that are *a priori* and valid prior to all experience" (B 198), which reasonably follows from Kant's basic epistemology, namely, that any necessary propositions must have an *a priori* origin. To recap: proper natural science requires a pure ***part***, *i.e.*, that on which necessity can be based (4: 469).[54]

Proper natural science "presupposes" a metaphysics of nature, that is, "[p]ure rational cognition from mere *concepts*" (ibid.). Because natural science

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[53] While improper science can constitute a system—and even a rational science, in the sense that it is an "interconnection of grounds and consequences"—because its principles are merely empirical, it is not a "science in the strict sense," but could be described as a "systematic art" (4: 468). Kant also seems to introduce yet another synonym for "systematic art," *i.e.*, "applied rational cognition" (ibid.). Just as one may refer to, e.g., chemistry as a science—if not a "proper" science—we could also refer to its laws as "contingent laws," though we are advised to remain mindful that these are not laws of so-called proper science, which hold with necessity (4: 469).

Relevantly, Watkins discerns several categories of laws in Kant's works, including, but not limited to moral laws, laws of nature, teleological laws, logical laws, and cosmological laws (2017, 13). While these laws are diverse, Watkins argues that there are two main criteria common to all of the rules Kant considers laws, namely, that (1) the rule holds with necessity; and (2) the rule is "established by a spontaneous act" (ibid., 15-16). Watkins asserts that we can account for the diversity in the types of laws by noting that there are (1) different kinds of necessity, (2) involving different faculties, (3) which perform different acts in order to constitute the laws (ibid., 16). An example would be the contrast between natural and moral laws, each of which has a different sort of necessity (determination versus obligation), owing to a different faculty (the understanding versus reason), performing a different function (prescription versus legislation). Just as Watkins surveys the several types of laws across Kant's works, Ameriks constructs a useful matrix of the types of necessity Kant employs (2017, 37).

[54] *Accord* Friedman 2017, 196 (noting that for Kant, empirical natural laws, such as the laws of physics, are both empirical and necessary, with *a priori* grounds).

requires a metaphysics of nature, the next inquiry must be what constitutes a metaphysics of nature. One way to determine what a metaphysics of nature *is* is to look to what it *does*. For Kant, a metaphysics of nature does two things: it "treat[s] the laws that make possible the concept of a nature in general, even without relation to any determinate object of experience" (that is, it establishes laws that hold for nature generally and not for any specific objects of experience); or, it "concern[s] itself with a particular nature of this or that kind of things, for which an empirical concept is given, but . . . no other empirical principle is used for its cognition," e.g., the concept of matter or of a "thinking being." Thus, a metaphysics of nature may be general, or it may be a "special" metaphysics of nature (of physics or psychology) (4: 469-70).[55]

All "true metaphysics" is derived from what Kant calls the "faculty of thinking" because it is the mind's *a priori* concepts and principles "which first bring the manifold of *empirical representations* into the law-governed connection through which it can become *empirical* **cognition**, that is, experience" (4: 472). That is, the *a priori* rules of the understanding, *i.e.*, the categories, give rise to general metaphysics insofar as general laws of nature may be derived from application of the categories to the concept of an object generally; and the categories give rise to a special metaphysics of nature,

[55] We must not neglect Kant's assertion that "there can be only as much *proper* science as there is *mathematics* therein" (4: 470), which Kant claims is the case because objects have extension, and the *a priori* cognition of extended bodies requires consideration of *a priori* intuitions, not just concepts alone (ibid). This is consistent with Kant's argument in the first *Critique* that mathematics provides synthetic *a priori* propositions about the pure intuition of space, *i.e.*, the form of extended objects. *See* B 15-16, 38-41. The issue of mathematization will recur at various points below.

specifically, the doctrine of body (*i.e.*, physics) insofar as they are combined with a potentially “infinite manifold of intuitions (pure or empirical)” (4: 473).

In either case, that of general or special metaphysics, the “schema for [the] completeness of a metaphysical system . . . is the table of categories” (4: 474). This is so because objects in general, as well as those “given as a determinate object of experience,” are represented according to the categories (4: 475-76). And finally: science is the metaphysical doctrine of body combined with the “data of intuition (pure as well as empirical),” which, due to indefinite manifold objects of experience, “can always be extended to infinity” (4: 473).

Thus, we return to Kant’s assertion in the first *Critique* that not only does the table of categories “completely contain[] all the elementary concepts of the understanding,” it also contains “even the ***form*** of a system of them in the human understanding,” and thereby gives “instruction” about the organization of “speculative science,” such as shown, he notes, in the *Metaphysical Foundations* (B 109-10). Having shown that the categories inform the special metaphysics of nature, a natural question to pose is why we should take the table of categories to provide instruction for the organization of a scientific system.

The link between the table of categories and a system of science consists of the premise that scientific laws are in some sense derivative of the *a priori* laws of the understanding contained in the categories.[56] In the A-Deduction, Kant

[56] Ameriks observes that Kant’s transcendental principles, “in contrast to what may be seen from a ‘God’s eye view’ . . . have a deep metaphysical contingency and, given transcendental idealism, even mask the fundamental features of things in themselves . . .” (2017, 46). Guyer similarly concludes that, for Kant, his transcendental idealism gives necessary, but not sufficient, conditions for knowledge of scientific laws, and, accordingly, they “cannot

states that the understanding is, among other things, a "faculty of rules," that is, it prescribes rules (A 126). Rules, "so far as they are objective . . . are called laws" (ibid.). The laws that the understanding prescribes are different from those discerned from observation in that they are not drawn from experience. As Kant explains:

> Although we may learn many laws through experience, these are only particular determinations of yet higher laws, the highest of which . . . come from the understanding itself *a priori*, and are not borrowed from experience, but rather must provide the appearances with their lawfulness and by that very means makes experience possible (A 126).

Thus, the understanding does not construct these *a priori* rules based on observations, but, instead, the understanding "is itself the legislation for nature," *viz.*, its rules make nature, as an object of experience, possible (A 127). So,

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guarantee that our claims to knowledge . . . are unrevisable" (2017, 66). Friedman also suggests that the development of non-Euclidean geometry and Einstein's theory of relativity show that Kant's two-fold conception of *a priori* (i.e., "necessary unrevisability" and "constitutive of the object of scientific knowledge") are separable, and that the *a priori* can be conceived of as "enabling conditions" (that is, constitutive of objects of scientific knowledge) while subject to revision (based on, for example, the development of non-Euclidean geometry and relativistic mechanics) (2017, 212-13). *See also* Reichenbach 1958, 32, 36 n.1 (arguing that "no *logical* self-evidence can be claimed for Euclidean geometry," and, accordingly, there is a "patent contradiction" between "modern philosophy of space" and Kant's philosophy); Hatfield 1995, 216 (observing that Kant's assertions about Euclidean geometry "must either be pared back to a psychological claim . . . or . . . accepted as [] claim[s] about the character of perceptual and physical space that turned out to be empirical, . . . and indeed, as is widely held, false").

The foregoing implies that Kant's scientific views, as a consequence of his transcendental idealism, are anti-realist. That said, throughout this chapter, we will necessarily touch on Kant's transcendental idealism insofar as it grounds natural science for Kant; however, the implications of Kant's transcendental idealism on his philosophy of science, namely, questions such as whether we should consider Kant a scientific realist, anti-realist, or something *sui generis* will be deferred to chapter five.

according to the A-Deduction, there is a sense in which empirical laws are derivative of, or stand under, the *a priori* laws of the understanding, because the categories make empirical experience possible. This premise makes more comprehensible how it can be that the categories can "instruct" or provide a "plan" for a system of science. Scientific laws are "particular determinations of yet higher laws," and so the form of the higher laws can reasonably be expected to influence the form of lower laws. Kant rejects in the A edition the proposition that empirical laws can completely "derive their origin from the pure understanding"; rather, empirical laws "are only particular determinations of the pure laws of the understanding, ***under which and in accordance with whose norm they are first possible***," and according to which the empirical world "assume[s] a lawful form" (A 128) (emphasis added).

Similarly in the B-Deduction, Kant maintains that the categories "prescribe laws *a priori* to appearances, thus to nature as the sum total of all appearances," or, in other words, they "determine *a priori* the combination of the manifold of nature without deriving from [it]" (B 163). At a minimum, empirical laws must agree with the laws of the understanding because the phenomenal world consists only of representations which have "no law of connection at all except that which the connecting faculty prescribes" (B 164). The grounding and dependence relation implicit in the language of the A-Deduction recurs in the B-Deduction, where, for example, Kant states that the empirical world "stand[s] under the categories" and depends on them "as the original ground of its necessary lawfulness . . ." (B 165). However, again, Kant claims that the categories cannot give specific empirical laws *a priori*, but only for "nature in general"; "particular laws, [however,] **cannot** be **completely derived** from the categories, although they all stand under them" (ibid.).

One way to understand Kant's account of why the categories ground empirical laws is that, because the whole of nature consists of representations, and the categories prescribe lawfulness among representations, the whole of nature must be generally subject to the categories, even if the categories do not prescribe with specificity each law that holds between representations. Thus, the categories govern the constitution of the objects of experience; and because the whole of nature contains objects of experience, the categories necessarily inform specific laws pertaining to those objects.[57] As Kant states in the Transcendental Deduction, "without exception[,] all laws of nature stand under higher principles of the understanding, ***as they only apply the latter to particular cases of appearance***," (B 198, emphasis added); that is, laws of nature are applications of the laws of the understanding to objects of intuition.

As will be shown below, Kant develops an *a priori* account of matter based on its inherent fundamental forces; he calls this "dynamical natural philosophy"

[57] If one of the functions of the understanding is to constitute, pursuant to its rules, objects of experience, then one might question in what sense the constituted objects are "objective." I take Friedman to be alluding to this issue when he remarks that "[t]here can be no *a priori* guarantee . . . that the proper object of pure understanding, namely, objective experience, is in fact constructible," but that the success of Newtonian physics demonstrates the realization of objectivity. *See* Friedman 1986, 57. As I see it, this relates to the issue of whether we should interpret Kant as expounding some form of realism, which of necessity implicates how to interpret his transcendental idealism. Again, this is the subject of chapter five.

(4: 532-33), the purpose of which is to guide natural science (4: 534).[58] As Kant argues, the utility in positing dynamical grounds of explanation is that these "alone permit the hope of determinate laws, and thus a true rational coherence of explanations" (4: 534). That is, the fact that natural science is grounded on *a priori* laws should ensure coherence in the laws of nature, given their common foundation.

2. The Categories and Principles of Pure Understanding

In the Metaphysical Deduction, Kant sets forth the table of judgments which he asserts contains the possible forms of thought. Kant reasons as follows. Concepts are ways of organizing representations; and judgment is cognition using concepts (B 93-94). Because the understanding is a "faculty of thought," that is, it cognizes things through concepts (B 94), all actions of the understanding may be "trace[d] . . . back to judgments" (ibid.). Thus, if we catalogue the functions of judgment, then by that same action we can give a taxonomy of the functions of the understanding (ibid.).

If we abstract from the content of a judgment, then we may find that "the function of thinking . . . can be brought under four titles, each of which contains under itself three moments": (1) quantity (universal/particular/singular); (2) quality (affirmative/negative/infinite); (3) relation (categorical/hypothetical/disjunctive); and (4) modality (problematic/assertoric/apodictic) (B 95). Quantity pertains to whether a

[58] Kant posits two fundamental forces, *i.e.*, attraction and repulsion, because motion must be due to a combination of objects being brought together (attraction) without penetrating each other (repulsion). *See*, *e.g.*, Brittan 1986, 64 (discussing B 321).

predicate "holds of [a] concept without exception" (universal), in just some cases (particular), or in only one case (singular). Quality pertains to whether an assertion is affirmative (e.g., the soul is mortal), negative (e.g., the soul is not moral), or infinite (e.g., the soul is non-mortal, that is, the soul is "one of the infinite multitude of things that remain if I take away everything that is mortal") (B 97). Relation's three moments include categorical (subject/predicate); hypothetical (ground and consequent); and disjunctive. Lastly, modality concerns whether a judgment is problematic (*i.e.*, possible), assertoric (actually true), or apodictic (necessary) (B 100).

Later in the Metaphysical Deduction, Kant asserts that "[t]he same function that gives unity to the different representations **in a judgment** also gives unity to the mere synthesis of different representations **in an intuition**, which . . . is called the pure concept of understanding" (B 104-05). That is, the same functions of the understanding in forming judgments, *i.e.*, the table of judgments, are active also in the understanding's synthesis of sensations into intuitions, as discussed in *supra* chapter two. These functions, when considered vis-à-vis the synthesis of sensations, are called the pure concepts of the understanding or the categories (B 105): (1) quantity (unity/plurality/totality); (2) quality (reality/negation/limitation); (3) relation (inherence and subsistence/causality and dependence/community); and (4) modality (possibility/existence/necessity) (B 106).[59]

[59] Kant splits the categories into two divisions: the mathematical, which includes quantity and quality; and the dynamical, which includes relation and modality (B 110). The mathematical categories relate to pure/empirical objects of

So far, we have gone from the table of judgment to the table of categories. The next step is the table of principles, which consists of "nothing other than rules of the objective use of the categories" (B 200). The principles of understanding include the following: (1) Axioms of intuition; (2) anticipations of perception; (3) analogies of experience; and (4) postulates of empirical thinking (ibid.).[60] The last step before examining the correspondence between the first *Critique* and the *Metaphysical Foundations* is to briefly elucidate Kant's table of principles.

The principle of the axioms of intuition is: "All intuitions are extensive magnitudes" (B 202). Kant reiterates that appearances cannot be "taken up into empirical consciousness" without the synthesis of a manifold, through which the representation of a "determinate space or time are generated" (ibid.). In other words, an "extensive magnitude" is a representation in space in which "the representation of the parts makes possible the representation of the whole" (B 203). Because intuitions are synthesized by the understanding into representations of objects, objects are extensive magnitudes. That is, appearances, or objects of intuitions, are "intuited as aggregates (multitudes of antecedently given parts)" (B 204). Additionally, Kant says that the synthesis of the productive imagination generates shapes according to the "mathematics of extension (geometry) with its axioms" (B 204). Thus, the axioms of intuition are

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intuition, and the dynamical categories concern the existence of those objects (ibid.).

[60] The axioms of intuition and anticipations of perception are mathematical principles, and the analogies of experience and postulates of empirical thinking are dynamical principles (B 201).

ostensibly geometrical axioms. This is crucial because "[e]mpirical intuition is possible only through the pure intuition (of space and time),

and so, "what geometry says about the latter is thereby undeniably valid of the former . . ." (B 206). That is, Kant argues that the geometry necessarily applies to empirical intuitions.

The principle of the anticipations of perception is: "In all appearances the real, which is an object of the sensation, has an intensive magnitude, *i.e.*, a degree" (B 207). More specifically, an intensive magnitude is a "degree of influence on sense" that can range from zero to its "given measure" (ibid., 208). Kant aims to establish in this section that every sensation (*viz.*, subjective sensory representation) as well as the appearance that causes it (*i.e.*, the external object) has, "however small it may be, . . . a degree, [that is], an intensive magnitude . . ." (B 211). Thus, there is the degree of sensation and the intensive magnitude which is the degree of the object's influence on our senses. This degree "can still always be diminished," as there is a "continuous nexus" of possibilities between reality and negation (ibid). All appearances are magnitudes, either insofar as they are intuitions (extensive magnitudes) or merely sensations (intensive magnitudes) (B 212).[61]

As for the analogies of experience, there is one general principle, and there are three analogies. The general principle is: "Experience is possible only

[61] The reason Kant uses the term "anticipations" is because "there is something which can be cognized *a priori* in every sensation, as sensation in general," antecedent to any particular sensory experience (B 209). Indeed, Kant says that while sensations are only given *a posteriori*, the property of "having a degree can be cognized *a priori*" (B 218).

through the representation of a necessary connection of perceptions" (B 218). The general principle concerns time. Our representations juxtapose objects in space and time, yet time cannot be perceived, therefore time must be an *a priori* connection (B 219). Time has three modi: persistence, succession, and simultaneity. Accordingly, there are "three rules of all temporal relations of appearances," which are set forth in the analogies of experience (ibid.).[62] The three analogies are as follows:

1) "In all change of appearances[,] substance persists, and its quantum is neither increased nor diminished in nature" (B 224);

2) "All alterations occur in accordance with the law of the connection of cause and effect" (B 232); and

3) "All substances, insofar as they can be perceived in space as simultaneous, are in thoroughgoing interaction" (B 256).

The postulates of empirical thinking in general can be treated summarily, because, as Kant says, the categories of modality, *i.e.*, possibility, actuality, and necessity, do not "augment the concept to which they are ascribed . . ., but rather express only [its] relation to the faculty of cognition" (B 266). That is, possibility applies to that which agrees with the formal conditions of experience (*i.e.* "in accordance with intuition and concepts"); actuality is that which is connected to the "material conditions of experience," *i.e.*, sensation; and necessity is that "whose connection with the actual is determined in accordance with general conditions of experience" (B 265-66).

[62] Kant notes that the analogies are not principles of the "transcendental use of the understanding but merely as principles of its empirical use" (B 223).

To recapitulate: we can trace a trajectory from the quadripartite table of judgments to the corresponding table of categories, to the four-prong principles of the understanding, each of which contains rules for the application of the categories to experience. However, as noted above, the categories cannot give specific empirical laws, but only general transcendental laws from which empirical laws may be derived, when mixed with observation. The next section concerns the bridge between the first *Critique's* transcendental laws and scientific laws, *i.e.*, the special metaphysics of nature that Kant develops in the *Metaphysical Foundations*.

3. The Correspondence Between the First *Critique* and the *Metaphysical Foundations*

As Kuehn observes, Kant sought to present the *Metaphysical Foundations* in accordance with mathematical methods, making the book "somewhat tediously subdivided" into various sections that render the work's argument "difficult to summarize" (2001, 303). Friedman describes it as being written in "an inhospitable and forbidding style – organized in quasi-mathematical fashion into definitions . . ., propositions, proofs, remarks, and so on" (2002, 173).[63]

[63] Friedman goes a step further by arguing that Kant's organization of the *Metaphysical Foundations* is not only an "annoying hindrance to the reader," but inconsistent with some of Kant's assertions in the first *Critique* in which Kant argues that philosophy should not imitate mathematics (2002, 177) (citing A 712-738/ B 740-766). Friedman also observes, though, that Kant uses a similar form in sections one through eight of the second *Critique*, and the Refutation of Idealism in the first *Critique* (2002, 178). Friedman notes that it makes sense for the form of the Refutation to correspond with the form of the *Metaphysical Foundations* given their related content, and suggests that perhaps Kant employed this style to "encourage a closer connection between metaphysics of nature and mathematical natural science" (ibid.).

The *Metaphysical Foundations*' organization is indeed abstruse. However, we may begin with the observation that it contains four categorial headings of quantity, quality, relation, and modality, which correspond to the four-part table of categories in the first *Critique*.[64] Recall that, for Kant, the categories provides a framework for "completely outlining **the plan for the whole of a science** insofar as it rests on *a priori* concepts"; and since it "contains all the elementary concepts of the understanding [and] indeed even the form of a system of them in the human understanding," it also gives "instruction" about the "**order**[] of a planned speculative science" (B 109-10).[65]

Recall from the above that, for Kant, a metaphysics of nature can concern either matter (physics) or thinking being (psychology). Therefore, a special metaphysics of matter, *i.e.*, physics, is directed toward the concept of matter. Matter, thus, must be "carried through" the four functions of the categories (4: 476).[66]

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[64] *Compare* B 106 *with* 4: 495, 4: 523, 4: 551, 4: 555-58. *See also* Guyer 2006, 159.

[65] *Accord* Guyer 2006, 158 (noting that in the *Metaphysical Foundations*, Kant takes the empirical concept of an object and seeks to "determine what can be known *a priori* about that object solely on the basis of the pure principles of the transcendental part of the metaphysics of nature which are nothing other than the fundamental principles for all knowledge already demonstrated in the *Critique of Pure Reason*"). *See also* Watkins and Stan 2023, 9 (noting that the *Metaphysical Foundations* is apparently "structured according to the *Critique of Pure Reason*'s table of categories").

[66] *See* Friedman 2001, 53 (stating that the "bridge between the two systems, between general metaphysics and special metaphysics, is what Kant calls 'the empirical concept of matter'") (citing 4: 470). There is some potential ambiguity about just what it is that the understanding constructs, namely, whether it constructs merely the sensory components of cognition, or whether the understanding also constructs the objects of cognition, *i.e.*, matter, the latter

Kant next reasons that matter constitutes objects of the senses, and, because the only way that matter may affect the senses is through motion, all predicates of matter must be traceable back to motion; therefore, "natural science . . . is either a pure or applied *doctrine of motion*" (4: 476-77). Accordingly, it is not simply matter that is to be analyzed under the categories, but the characteristics matter has vis-à-vis motion (4: 477): Quantity, from the first *Critique*, corresponds to the *Metaphysical Foundation*'s phoronomy, which we might understand generally as kinematics (or what Guyer describes as "purely geometrical laws of motion" (2001, 159)). In parallel form: quality corresponds to dynamics (how moveable matter fills space); relation corresponds to mechanics (conservation of substance and causality); and modality corresponds to phenomenology (*i.e.*, how to discern real from apparent motion) (ibid., 159-60).[67]

a. Phoronomy

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of which (matter) is in part causally responsible for the former (cognitions). We know from the Transcendental Deduction that Kant asserts that the understanding combines sensations into representations of objects, that is, it gives form to sensory content, but how is it that Kant can move from the form/sensation dichotomy to form/matter?

Consistent with this observation, Brittan, for example, has noted the "twofold" way in which Kant treats matter, *i.e.*, as a "product of our conceptual activities," but also as the cause of cognitions (1986, 81). Friedman has described the relation between the empirical concept of matter and the categories as presenting "what appear to be insuperable difficulties" (2001, 54). Any satisfactory resolution of this issue will have to address more fundamental questions about Kant's transcendental idealism and whether the external objects it posits are phenomenal or noumenal, internal or external, and so forth. I return to this issue in chapter 5.

[67] *See generally* 4: 477.

The first category is quantity (unity/plurality/totality) (B 106). Its principle of understanding is the axioms of intuition (which concerned extensive magnitudes, that is, the applicability of geometrical axioms to objects of experience) (B 200). Accordingly, the *Metaphysical Foundations'* first chapter, phoronomy, is concerned with "motion and what can be considered as quantity in motion (speed and direction)" (4: 480). In other words, phoronomy relates to the property matter has of being moveable in space (4: 482).

Kant distinguishes phoronomy from geometry in that geometry considers points in space, whereas motion is the movement of matter (points in space) in time at a given speed (4: 489). Working under the assumption that all motion, relative to space, is rectilinear, *see* 4: 488, and that any single motion may be a composite of two or more motions at the same time, *see* 4: 489, Kant discerns three types of motion: (1) two motions in one and the same line and direction (with equal or unequal speeds); (2) two motions combined in opposite directions in one and the same point (which results in the body's motion being at rest if the speeds in opposite directions are the same, or its motion is "equal to the difference of the speeds in the direction of the greater" (4: 491)); and (3) what is essentially a vector, that is, one point with motion in two or more different directions, which together, comprise an angle (4: 492).

In the concluding section of the phoronomy, Kant explains that quantity "always contains that of the composition of the homogenous," and phoronomy is the doctrine of the composition of motion (4: 495). The three moments of quantity (unity, plurality, totality) correspond to the three types of motion: "*unity* of line and direction, *plurality* of directions in one and the same line, and the *totality* of directions, as well as lines, in . . . which the motion may occur," which, Kant maintains, exhausts "all possible motion" (ibid., 4: 495).

b. Dynamics

Recall that the second category was quality (reality/negation/limitation) (B 106). Its principle of understanding is the anticipations of perception, which concerned objects' intensive magnitudes, *i.e.*, their degree of impact on the senses (B 200). The tripartite moments under the category of quality—reality, negation, and limitation—are expressed in dynamics by the following: the real (solidity) in space; negation (destruction of solidity); and limitation (the degree of filling of a space) (4: 523). Kant explains how dynamics relates to the anticipations of perception, more specifically, intensive magnitudes, as follows:

> The general principle of the dynamics of material nature is that everything real in the objects of **outer sense**, which is not merely a determination of space (place, extension, figure), must be viewed as moving force (ibid.) (emphasis added).

That is, just as quantity pertains to extensive magnitudes (*i.e.*, extension in space), quality pertains to intensive magnitudes (*i.e.*, the degree of matter's affection of the senses), which occurs *via* motion, or, moving forces.

Earlier in the Dynamics, Kant explains that matter fills space through "a *particular moving force*" (4: 497) (emphasis in original). There are two types of fundamental forces, attractive (AKA "drawing" force) and repulsive (AKA "driving" force). As their names suggest, attractive forces cause matter to draw together, and repulsive forces cause matter to "remove" themselves from each other (4: 489). The quality matter has of filling space, Kant states, is due to its repulsive forces (4: 499).[68] That a quantity of matter is not "dispersed [into] infinity" is due to the attractive forces holding it together (4: 508-509). Repulsive forces prevent attractive forces from causing matter to coalesce into a single mathematical point (4: 511).[69] Kant posits that there is an "original attractive force" extending to infinity through the universe connecting "every part of matter to every other part" (4: 516), which is gravitation (4: 518), and the movement of objects pursuant to which is called weight (ibid.).

Putting the mechanics and dynamics together, Kant defines a body as "*a matter between determinate boundaries* (which therefore has a figure)"; and the space between those boundaries has a magnitude (extension) which we call volume, and the "degree of the filling of the space" (intensive magnitude) is density (4: 525). States of matters, including fluidity and solidity (or "rigidity"), are also defined in terms of the interaction of matter and fundamental forces (4: 526-27).

c. Mechanics

In the Dynamics, Kant defines "mechanical natural philosophy" as the "mode of explaining the specific variety of matters by the constitution and

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[68] Repulsive forces endow matter with other characteristics not germane to this generalized discussion (4: 501-02). It suffices to note that physical contact is the "action and reaction of *impenetrability*" (4: 511), that is, it is the interaction of two objects' repulsive forces "at the common boundary of two matters" (4: 512). There are further subdivisions of forces, including surface force (action at the common surface contact of two objects) and penetrating force (action of a quantity of matter on another beyond surface contact) (4: 516).

[69] In his pre-Critical period, Kant attributed these forces to "indivisible 'physical monads'" (Guyer 2006, 159). Watkins and Stan note that Kant's change of heart on this issue results from his "critical turn" (2023, 13).

composition of their smallest parts, as machines . . ." (4: 532). A machine is defined as a "body (or particle) whose moving force depends on its figure," by which Kant ostensibly means the "constitution and composition of its smallest parts," *i.e.*, the atom, which is a "small part of matter that is physically indivisible" (ibid.).[70] Kant defines mass as an aggregate quantity of matter in a determinate space acting/moving together in their motion, also known as a "body" (4: 537). A "quantity of motion" is the combined quantity of moved matter and its speed (ibid.). Mechanical laws—that is, the various manners of communication of motion between bodies—derive from dynamical laws, because matter could have no moving forces at all but for attractive and repulsive forces (4: 536-537).

The third category is relation (inherence and subsistence/causality and dependence/community) (B 106). Its principle of understanding is the analogies of experience (B 200), which concerns persistence, causality, and simultaneity. Based on the apparent pattern thus far, we can infer that the mechanics relates to causality.

Kant sets forth his three laws of mechanics as follows:

1) "In all changes of corporeal nature[,] the total quantity of matter remains the same, neither increased nor diminished" (4: 541).

2) "Every change in 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.)" (4: 543).

[70] To be more precise, as Friedman puts it, in the *Metaphysical Foundations*, Kant posits that matter is infinitely divisible, but never in experience infinitely divided (2002, 174).

3) "In all communication of motion, action and reaction are always equal to one another" (4: 544).[71]

Pursuant to Kant's first law of mechanics, matter consists of some substance that is, what he calls, "the ultimate subject of all accidents inhering in [it]," and this substance never comes into being or perishes, and so its quantity never increases nor decreases. Instead, "somewhere in the world it persists in the same quantity, although *this or that matter* can be increased or diminished, through addition or separation of parts" (4: 542) (emphasis added). This connects to the category of relation, specifically the first moment, *i.e.*, inherence and subsistence, and to the first analogy of experience, namely, that substance persists and neither increases nor decreases in nature.[72]

Recall that the second movement of the third category (relation) was causality and dependence, and, per the second analogy of experience, all alterations occur according to cause and effect. As one might expect, the second law of mechanics concerns causality. In Kant's second law of mechanics, he

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[71] Kant's Mechanics section is sometimes taken to constitute an *a priori* proof of Newton's "three laws of . . . mechanics," see, *e.g.*, Guyer 2006, 162, but, as Kuehn notes, Kant's laws of mechanics do not correlate exactly to Newton's (2001, 304). Kant's first law of mechanics corresponds to Newton's principle of the conservation of mass; Kant's second law of mechanics corresponds to Newton's first law of motion ("the principle of rectilinear inertia"); and Kant's third law of mechanics corresponds to Newton's third law of motion, while Kant gives no express correlate to Newton's second law (ibid.). *See also* Carrier 2001, 118 (noting that Kant's propositions in his Mechanics section are not identical to Newtons laws, and that Kant has no correlate for Newton's second law); *see also* Watkins 2001, 137 (showing that Kant does not mention Newton's second law, and, in fact, a line by line comparison of Newton and Kant reveals that "none of Kant's laws of mechanics is identical to any of Newton's laws of motion").

[72] According to Carrier, Kant's aim in the first proposition is to "ground the determination of mass on the moving force that matter possesses . . ." (2001, 118-19).

reasons from the premise that every change has a cause to: this cause must be an external one, because "matter has no essentially internal determinations or grounds of determination" (4: 543). That is, with respect to motion, given that matter changes from one motion to another, or goes from being in motion to being at rest, there must be a cause. And since there are no explanations for how changes in motion in matter could come from the matter itself, the cause of the change in motion must be external (ibid.). The reason there is no internal explanation for changes of motion in matter is that matter is lifeless, in contrast to living matter, which has the power to "determine itself to act from an internal principle" and thereby change its motion or state (4: 544).[73]

The third movement of the third category is community, and its corresponding analogy of experience is: "All substances, insofar as they can be perceived in space as simultaneous, are in thoroughgoing interaction" (B 256). Kant's third law of mechanics specifies the nature of this interaction of substances, namely, that action and reaction are always equal to one another (4: 544). The reason for this is the motion of bodies is relative, and so one body cannot be thought to be absolutely at rest, but only at rest relative to a particular space (4: 545). Thus, when body A is moved as a consequence of communication of motion from body B, each has an equal and opposite quantity of motion (ibid.).

[73] To attribute internal determination to matter would be "the death of all natural philosophy," as it would result in what Kant calls "hylozoism" (4: 544). Hylozoism is the "doctrine that matter is intrinsically alive, or that all bodies . . . have some kind of life" (Mourelatos 2015, 487).

The above establishes that the three laws of mechanics correspond to the three movements of the category of relation. Kant confirms as much toward the end of the Mechanics:

> The three laws of general mechanics could therefore more appropriately be named laws of *self subsistence*, *inertia*, and *reaction of matters . . . in all of their changes*. That these laws . . . precisely answer to the categories of *substance*, *causality*, and *community*, insofar as these concepts are applied to matter, needs no further discussion (4: 551).

d. Phenomenology

The fourth category is modality (possibility/existence/necessity) (B 106). Its principle of understanding is the postulates of empirical thinking (B 200). The postulates address modality, *i.e.*, possibility, actuality, and necessity. As Kant says, the three propositions in the Phenomenology section of the *Metaphysical Foundations* address the motion of matter vis-à-vis its possibility, actuality, and necessity, that is, in accordance with the category of modality (4: 558).

The first proposition, in relevant part, provides that "[t]he rectilinear motion of a matter with respect to an empirical space, as distinct from the opposite motion of the space, is a merely *possible* predicate" (4: 555). The reason for this is that it is "undetermined" whether objects of experience in motion are moving in relative space or whether the relative space is moving vis-à-vis the object; Kant concludes from this premise that "that which is in itself undetermined with respect to two opposed predicates is to that extent *merely possible*" (4: 556).[74]

The second proposition in the Phenomenology is that circular motion of matter is an *actual* predicate of the matter (4: 556-57). The reason for this is that bodies in circular motion are moving in straight lines along the tangents of a circle, but constantly changing direction; this change in direction must have an external cause, *i.e.*, some moving force. But space has no moving force. Accordingly, all circular motion occurs due to some moving force, which excludes the possibility of space moving circularly, because space has no moving force. Therefore, the circular motion is not a merely possible predicate of matter, but an actual predicate (4: 557).

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[74] The *Metaphysical Foundations* is something of an attempt by Kant to merge his Leibnizian and Newtonian views. For example, Friedman observes that pre-Critical Kant rejected absolute space and instead posited space as nothing more than a relation between noumena; however, in the *Metaphysical Foundations*, Kant attempted to chart a middle path between Leibnizian "relationism" and absolute space (2002, 174). *See also* Kuehn 2001, 303 n. 121, 305 (noting the same). While Kant continued to reject the notion of absolute space in the *Metaphysical Foundations*, he nevertheless attempted to distinguish between true and apparent motion (Friedman, 2002, 174). We see this below in the discussion of Kant's treatment of circular motion.

As for the degree of influence of Newton and Leibniz on Kant, Watkins and Stan note that the general consensus in Kant scholarship used to be that Kant's laws of mechanics were identical with Newton's, but more recent work has demonstrated that Kant's laws were "strongly influenced by a philosophy of nature stemming from Leibniz, not Newton" (2023, 19). That said, others argue that Kant's reliance on dynamical modes of explanation (*i.e.*, force and power), as opposed to mechanical modes of explanation ("size, shape and motion of bodies") can be traced to the influence of both Leibniz and Newton (Warren 2001, 93-94). Watkins argues that to fully understand why Kant diverges from Newton, we must consider the influence of the "rationalist, Leibnizian-Wolffian tradition in which Kant is trained and to which he is reacting . . ." (2001, 138).

The third and final proposition is that "[i]n every motion of a body, whereby it is moving relative to another, an opposite and equal motion of the latter is *necessary*" (4: 558). This proposition is in some sense derivative of the third law of mechanics, which is that the communication of motion between bodies requires a "community of their original moving forces" which necessarily includes "mutually opposite and equal motion" (ibid.).

4. Conclusion

While it is beyond the scope of this chapter, and indeed this project, to consider in any appreciable detail the question of whether, or to what extent, Kant actually achieved his aim in the *Metaphysical Foundations*, that is, whether he successfully established a special metaphysics of nature and thereby set forth the transition from metaphysics to natural science. However, it should be noted that Kant, from 1796 up until he died, felt that his Critical philosophy was incomplete, and so began work on a new project, never completed, known now, as it has been compiled, as the *Opus postumum* (Friedman 2002, 176-177).

Friedman points out that the title of Kant's final project is revealing: *Transition from the Metaphysical Foundations of Natural Science to Physics* (ibid., 177). As Ameriks notes, Kant never "[got] around to supplementing the *Metaphysical Foundations* . . . with a completed 'transition' to a full philosophy of physics in his *Opus postumum*" (2001, 39), but its title suggests what Friedman describes as Kant's "fundamental reconsideration of the philosophy of natural science" presented in the *Metaphysical Foundations* (2002, 176-177). This turnabout is notable given that Kant, once he completed work on the

Metaphysical Foundations, "turned to other matters," until his *Opus postumum* (Kuehn 2001, 305, 305 n. 134).

Förster notes that Kant remarked in 1798 that there was a "gap" in his critical philosophy which he sought to fill with his then-current work (1987, 533). This, of course, is puzzling because Kant apparently completed his critical system upon publication of the *Critique of the Power of Judgment*, and he declared in the *Metaphysical Foundations* that he had "exhausted this metaphysical doctrine of body" (Förster 1987, 533-34 (quoting 4: 473, 476)). Förster argues that the "gap" in Kant's critical system is a "different[] and independent [] problem" from the transition project (1987, 551), and the gap in the Critical system resulted from Kant's reappraisal of the status of mathematics, following the *Metaphysical Foundations*. In the post-Critical period, Förster maintains, Kant no longer took mathematics to be "part of the system of the moving forces of matter" (ibid., 549).[75] Förster argues that Kant had, in the *Metaphysical Foundations*, taken math to be a crucial component of proper science; but, later, he concluded that mathematics can only "stud[y] motions and the moving forces that *result* from them," and, accordingly, mathematics does not extend to a body's "*own* moving forces"; therefore, mathematics "can play no part in the philosophical doctrine of body" (ibid., 549-50). If the *Metaphysical Foundations*' purpose was to provide a real application of categories and principles of the understanding—and this was

[75] Förster notes that his evidence is admittedly "indirect," and Kant did not frame the issue as he, Förster, has; consequently, there has been "endless puzzlement" about the supposed gap in the Critical system (1987, 551). As noted above, these issues are relevant to this project, but analysis of the *Opus postumum* is outside of its scope, and so no position is taken on Kant's later reflections on his prior work.

in fact its purpose, as shown above—then Kant's later reappraisal of mathematics puts the *Metaphysical Foundations*' achievement in jeopardy, that is, the "objective reality and real applicability" of the categories and principles of the understanding has no longer been shown (ibid., 550). This is what Förster takes the gap to be.

Friedman, however, interprets the gap differently. Friedman argues the gap is between constitutive and regulative procedures; that is, the method of the *Metaphysical Foundations* was constitutive, *viz.*, it started with general rules (*i.e.*, the Categories) and then discerned more specific applications of them as applied to matter. However, by the *Critique of the Power of Judgment*, Kant had also introduced a regulative procedure, namely, the organization, or "systematization" of specific empirical laws under "higher level empirical concepts and laws so as to approximate thereby to an ideal complete science of nature" (1992, 51). But, Friedman questions, what guarantees that the higher-level laws developed through the regulative procedure will converge toward those used in the constitutive procedure (ibid.)? Friedman thus takes the gap to be the possibility of a disconnect between these two components of the Critical system (*i.e.*, constitutive and regulative procedures). The *Transition*, Friedman maintains, is a response to the problem of a gap; that is, the *Transition* is intended to unite regulative and constitute procedures by establishing principles that are both (ibid., 305).[76]

[76] *See also* Watkins and Stan 2023, 25 (noting that the gap has been interpreted to relate to, *inter alia*, Kant's theory of matter or, alternatively, his "constitutive and regulative approaches").

Regardless of what we take the gap to consist, it must be acknowledged that, at least during Kant's Critical era, he believed the *Metaphysical Foundations* "complete[d] the system of an articulated speculative science mentioned in the second edition of [the first *Critique*]" (Butts 1986a, 15). Indeed, according to Butts, whatever Kant might have argued in his later writings must be weighed against "his entire career, including most importantly his *published* works and his many letters" (ibid.), including an August 7, 1799 open letter Kant wrote in which he proclaimed the completeness of his "pure philosophy."[77] More specifically: Kant claimed that "the system of the *Critique* rests on a fully secured foundation, established forever; it will prove to be indispensable too for the noblest ends of mankind in all future ages" (1799, 560). This 1799 letter post-dates both of the 1798 letters Förster cites for support in which Kant references a gap in his philosophy (1987, 533). Thus, however we understand the "gap," the evidence for it in Kant's Critical system is equivocal. Moreover, as Watkins and Stan observe, the *Opus* "mostly lacks" a "stable doctrine," but instead evinces the "evolution, background and import of his reflections" (2023, 24). We thus must weigh it accordingly against Kant's earlier published works and letters, as Butts suggests. Of course, even setting aside the issue of whether there was a gap in

[77] Butts also cites to a January 1791 letter—which post-dates the *Metaphysical Foundations*—in which Kant reiterated the arguments of the *Metaphysical Foundations* as proof that Kant "took the system of transcendental principles to be complete and to provide grounding for the speculative science of pure physics and understood the method of metaphysics to be secure" (1986a, 18). Butts identifies three of Kant's works as constituting the "crucial Kantian trinity": the first *Critique* (in which Kant provided, *inter alia*, a general metaphysics of experience); the *Metaphysical Foundations* (in which Kant set forth his special metaphysics); and the third *Critique* (in which Kant gave the regulative ideas of reason which methodologically guide scientific inquiry) (ibid.).

Kant's philosophy, it is undisputable that he was working in his later years on the *Transition*; but the following questions remain unsettled: how should we understand the gap? Was there in fact such a gap? How does Kant's *Transition* relate to the gap?

In any event, and to summarize thus far, Kant's post-*Critical* writings are equivocal evidence about whether he retrospectively considered his Critical system to be complete. The examination of the *Metaphysical Foundations* and the *Critique of Pure Reason* undertaken herein shows a tightness of fit that suggests that the *Metaphysical Foundations* is in some respects the culmination of the *Critique of Pure Reason*, at least with regard to the metaphysics of science. The foregoing discussion shows that the four-part treatment of the concept of matter in the *Metaphysical Foundations* tracks the structure of the categories and corresponding principles of understanding from the first *Critique*; and after the publication of the *Metaphysical Foundations*, and even after Kant's 1798 assertion of a gap in his philosophy, he suggested as late as 1799 that his pure philosophy was complete. Thus, we need not concern ourselves with searching for a gap in Kant's Critical philosophy *from the standpoint of Critical-era Kant*. However, the extent to which post-Critical Kant perceived a gap, whether there in fact is a gap from the standpoint of post-Critical Kant, and how the *Transition* relates to that gap, are outside of the scope of this project.

Rather, the next task at hand—having elucidated the general framework for the relation between the *a priori* laws of the understanding in the first *Critique* and the metaphysical laws in the *Metaphysical Foundations*—is to turn our attention to the special metaphysics of thinking nature, that is to shift from physics to psychology. Acknowledging that Kant asserted his belief that there could be no proper psychological science (4: 471), the next chapter will explore the following: Kant's reasons for rejecting the possibility of a psychological science; whether there could be a psychological science that Kant could recognize as proper science; whether it is feasible to construct a framework for a special metaphysics of thinking nature in a manner Kant could accept, or in a manner that is at least recognizably Kantian; and, if so, how to establish this framework for the special metaphysics of thinking nature, following the trajectory of this chapter vis-à-vis its treatment of Kant's special metaphysics of extended nature (*i.e.*, body).

CHAPTER 4
A NEW APPLICATION FOR KANT'S MODEL FOR SCIENCE: A KANTIAN APPROACH TO THE METAPHYSICAL FOUNDATIONS OF PSYCHOLOGY

The conventional wisdom is that Kant disallows the possibility that psychology can constitute a proper science. Generally speaking, this stems from the following: the strict requirements Kant requires any system to meet in order for that system to constitute a proper science (that is, apodictic certainty based on *a priori* principles and mathematization (*i.e.*, the ability to apply mathematics to the objects of inquiry)); as well as other doubts Kant expressed specifically about the feasibility of developing a scientific methodology for observing the objects of psychological inquiry.[78]

Guyer, for example, notes that Kant maintains there can be "no science of psychology," chiefly because mathematics cannot be applied to the structure of thoughts (2006, 158-59). Watkins and Stan make a similar point, *i.e.*, that the traditional take on Kant's view has been as follows: mental phenomena—more

[78] We would do well to distinguish Kant's approach to the science of psychology from his criticism of "rational psychology" in the Paralogisms of the first *Critique*. The Paralogisms are directed at "rational psychologists," such as Descartes, Wolff, and Baumgarten, who thought it could be proven that the soul is a simple, immortal, and numerically identical subject (Guyer 2006, 134-35). As Guyer summarizes it: for Kant, rational psychologists err because "they mistake the merely formal features of the *representation* of the self for metaphysical characteristics of the self as a substance" (2006, 135). *See also* Kuehn 2001, 246 (noting that the object of empirical psychology is the phenomenal self rather than the noumenal self and, therefore, rational psychologists, who seek to establish ontological claims about how the self "really" is, are mistaken). *Accord* Grier 2018 (observing that rational psychologists such as Descartes and Leibniz "seek to demonstrate, for example, the substantiality, simplicity, and personal identity of the soul," which Kant rejects based on their reliance on fallacious reasoning from the formal characteristics of mind to ontological claims); Sturm 2001, 163.

specifically "inner sense," which is a term of art discussed more fully below— are not subject to mathematics, and, accordingly, psychology cannot be a proper science, given Kant's requirement that proper science requires mathematization (2023, 8, 35). And, while Kant acknowledges that mental phenomena contain an *a priori* form (*i.e.*, time), this is insufficient grounds for the mathematization proper science requires (ibid., 35).[79]

Watkins and Stan note that more recent scholarship has focused not only on psychology's apparent resistance to mathematization, but also on empirical psychology's inability to generate genuine laws (2023, 35). That is, while empirical psychology may discern laws of association or other patterns that hold in the relations between thoughts or other mental phenomena, these "laws" are too weak to satisfy the necessity Kant demands of the laws of proper science (ibid.).

Notwithstanding Kant's manifest skepticism about the development of a proper science of psychology, his views on the mind—specifically, what has been described as the "complex contributions that must be made by the mind in order to enable us to have experience of a world[, which] seem[] to anticipate developments in cognitive psychology" (Allais 2017, 27)—make his psychological views worth examining. For that matter, enough scholars have noted that Kant's philosophy of mind is something of a predecessor to functionalism that "[i]t is no longer a novelty to view Kant as a functionalist about the mind or self" (Lau 2014,

[79] *See* Mischel 1967, 600-02 (explaining that psychology cannot be a proper science for Kant because it is not mathematizable, since mathematics applies to the pure intuition of space, and inner sense is not in space, but rather time).

371). *See also* Brook 2004, 6 (arguing that Kant "held a functionalist view of the mind almost 200 years before functionalism was officially articulated in the 1960s . . .."); Brook 2007, 124-25 (arguing that Kant is a predecessor to functionalism).[80] As Brook and Wuerth have observed, Kant's views on the mind were influential in "the empirical psychology that flowed from his work," and, after a lull, became once again of interest in the latter part of the twentieth century (2020, 3).[81] Indeed, the concept, in cognitive science, of perceptual binding[82] is recognizably (albeit not indisputably) Kantian (ibid., 39), in that

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[80] Brook rightly argues that Kant was a representationalist and held that the mind was a "system of functions for applying concepts to percepts," and, as such, he qualifies as a functionalist (2007, 124).

See also McDonough 1995, 204 (noting that several scholars have declared Kant "an ancestor of cognitive science"); Meerbote 1990, 161, 163-64 (arguing that Kant's transcendental psychology is a "cognitive psychology," namely, notwithstanding Kant's several assertions that psychology cannot be a proper science).

[81] *Accord* Gouax 1972, 237.

[82] Westphal explains the binding problem as follows: "[I]n the midst of our plethora of sensations, how do we identify any one object or event as the source of several sensations, both within any one sensory mode, and across sensory modes . . .?" (2004, 89). He distinguishes two variants of the binding problem, the first of which is how it is possible for a subject to construct an object from "our manifold sensations," and the second of which is our ability to identify an object based on our recognition of its "plurality of manifest characteristics" (ibid.). Burwick however identifies two different categories of binding problems: (1) determining mechanisms for binding; and (2) understanding various problems the brain might have vis-à-vis binding (2014, 312). He describes two strands of research into the binding problem focusing on two "levels of understanding": attention (psychological) and temporal correlations for neural correlates (neurophysiological) (ibid.).

The binding problem can be divided into finer distinct problems: (1) property binding (*e.g.*, shape, color); (2) part binding (parts of an object); (3) range binding (properties which result from the combination of ratios of other properties requiring activity by distinct neuronal populations); (4) hierarchical binding (binding of shape and surface properties); (5) conditional binding ("in combination, viz., the intellectual synthesis of sensory information into objects of cognition (discussed in *supra* chapter two), can reasonably be described, in somewhat anachronistic terms, as "Kant's . . . response to what is now called the 'binding problem' in neurophysiology of perception . . ." (Westphal 2004, 89). Brook notes that Kant has not only anticipated binding, that is, the synthesis of various representations in an object of perception, but also "global representation," that is, the representation of many objects in one consciousness (2007, 127).[83]

Thus, Kant's philosophy of perception—and his views on empirical psychology—are of continuing relevance, since he, to some extent, anticipated specific doctrines in cognitive science, and closer inquiry of his views may also direct (positively or negatively) future research.[84]

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which the interpretation of one property (e.g. direction of motion) often depends on another (e.g. [] occlusion [])"; (6) temporal binding (same object bound to subsequent temporal representations); and (7) location binding ("linking 'what' to 'where'") (Treisman 1996, 171).

Generally the binding problem appears to be approached from psychological and neurophysiological methods in a complementary manner; that is, psychological evidence is gathered from "normal" and brain-injured subjects, models are constructed which could account for the observational evidence, and then neural substrates are posited which could implement the model that explains the observational evidence. *See ibid.*, 172, 175.

[83] More generally, Brook observes that there are at least three Kantian threads woven into contemporary cognitive science: (1) the intertwining of concepts and intuitions; (2) the transcendental method (*i.e.*, discerning what the mind must be like in order for it to have the representations it has); and (3) "his general picture of the mind as a system of concept-using functions whose task is to manipulate representations" (2007, 126).

[84] *Accord* Brook 2007, 117 (noting that Kant can be thought of as the "intellectual grandfather of contemporary cognitive science").

To that end, this chapter is organized as follows: part one will examine Kant's views on the science of psychology and what he perceived to be its limitations, and will make the case that when Kant rejects the possibility of psychology, it specifically regards the study of "inner sense"; part two will make the case that Kant's views do not preclude the possibility of a proper science of psychology insofar as the object of inquiry is limited to outer sense; and part three will provide a roadmap for the construction of a metaphysical foundations for cognitive science, taking as its exemplar the structure of Kant's *Metaphysical Foundations of Natural Science* as presented above in chapter three.

1. Kant's General Views on the Science of Psychology

To briefly recapitulate some of the relevant distinctions: in the *Metaphysical Foundations*, Kant divides nature into two subsets: body and soul, or extended and thinking nature (respectively) (4: 467). Nature may be approached in two general ways; the first is historically, that is, "systematically ordered facts about natural things," including description and classification; the second is scientifically (4: 468). Science, as discussed previously, may be further subdivided into proper and improper science, that is, whether the methodology is "wholly according to *a priori* principles [or] according to laws of experience" (ibid.). Proper natural science thus presupposes a metaphysics of nature, that is, *a priori* cognition grounded in "mere concepts" (4: 469) (italics omitted). Metaphysics can be either general, *i.e.*, transcendental, in that it treats objects in general "without relation to any determinate object of experience," or it may be "special," that is, it may "concern itself with a particular nature of this or that kind of things, for which an empirical concept is given," but in a manner in which "no other empirical principle is used for its cognition" (4: 469-70). Special metaphysics may be further divided into special metaphysics of physics or psychology, what Kant calls "the two species of objects of our senses" (4: 470).

Initially, Kant's taxonomy of potential sciences and metaphysics ostensibly leaves open the possibility of a science, or at least a special metaphysics, of psychology. However, in a famous (or infamous) passage in the *Metaphysical Foundations*, Kant concludes that psychology, or the "doctrine of soul" (AKA thinking nature), can never rise to the level of being a proper natural science (4: 471). Kant explains that this is, firstly, because "mathematics is not applicable to the phenomena of inner sense and their laws because phenomena of inner sense are subject to only one dimension, namely, time" (ibid.). Secondly, observation of mental phenomena "already changes and displaces the state of the observed object," and, additionally, mental phenomena are divisible only "in thought," and thus cannot be separated and recombined at will (or, in other words, subject to scientific experimentation) (ibid.). For these two reasons, "the empirical doctrine of the soul can never become anything more than an historical doctrine of nature," *i.e.*, "a natural description of the soul, *[and] never a science of the soul, nor even, indeed, an experimental psychological doctrine*" (ibid.) (emphasis added).[85]

[85] *Accord* Gouax 1972, 240 (explaining that psychology cannot be a science for Kant for several reasons, including its lack of susceptibility to mathematization and its inability to be subject to "objective observation and experimentation"); Makkreel 2001, 191 (noting that Kant rejects psychology as a science because it is not mathematizable, on account of inner states having only one dimension, *i.e.*, time).

McDonough offers a novel explanation for Kant's rejection of psychology as a science—he attributes Kant's position to a refusal on Kant's part to accept the "correspondence thesis," defined as "the view that mental states correspond with brain states" (1995, 204). McDonough's argument is that Kant takes science to be causal and mechanistic (which requires the interaction of discrete parts); yet inner sense is not subject to division into parts, and, therefore, it cannot be susceptible to mechanistic explanations (ibid. 207-11). *See also* Mischel 1967, 604 (noting that Kant rejects the "possibility of ever developing a mechanics of mental states," which is why psychology can never be a proper science).

Interestingly, McDonough gives something of a Sellarsian interpretation of Kant by noting that mental states are in an "externalist" relationship with prior states, or, as McDonough puts it, "cognitions are *logically-embedded* in a history of cognitions" (ibid., 212), which is reminiscent of Sellars' claim that knowledge is situated in what is known as the "space of reasons," *i.e.*, a domain of normative, rather than causal, relations. (Hatfield 1995, 223 notes that the contrast between the space of reasons and causation has proven to be one of Kant's lasting legacies, controversial though it might be.) As McDonough frames it, Kant could be neither a reductionist nor an eliminativist about mental phenomena. Indeed, Kant, McDonough argues, drew a "principled dichotomy between the natural sciences and the historical or human sciences" (ibid., 214). This is a fascinating interpretation of Kant's account of the mind-body problem.

Nayak and Sotnak concede that we should consider ascribing to Kant "the view that all sciences ultimately boil down to physics even if, perhaps, they retain their old names" (1995, 147); and Kant's rejection of psychology as a science stems from his belief that "[s]ince psychological phenomena may be ultimately grounded in some non-corporeal nature (we cannot, ever, be sure), it cannot be reduced to physics"). Ultimately, Nayak and Sotnak instead conclude that psychology cannot constitute a science because it is not "lawlike" enough for Kant (ibid.). This is based on the fact that causality is not applicable to psychological phenomena; observation affects the object observed; it is difficult to discern an "objective rule of succession" of mental states; "[p]sychological phenomena lack the sort of objectivity, permanence, and regularity that are required of a genuine science"; and to the extent that the psychological phenomena at issue are merely inner sense, they cannot be properly mathematized (ibid., 149). Hatfield, however, disputes the idea that Kant believed there were no universal natural psychological laws; rather, Hatfield argues, Kant's rejection of psychology "resulted from specific methodological requirements he imposed on any 'proper' science . . ." (1992, 219).

A provocative alternative account of Kant's rejection of psychology as a science is found in Mischel, who, as noted above, interprets Kant in context of mind-body problem, and argues that this problem rests on a misapprehension of the nature of internal and external phenomena because, for Kant, outer and inner sense are subsets of mental representations—thus, by implication, the question of

It thus seems beyond cavil that Kant rejected the possibility of psychology, or at least some *sense* of psychology, as a science. A natural question, based on the foregoing, then, is to attempt to discern what exactly constitutes psychology for Kant. This is a challenging task because, while "Kant maintained a profound interest in psychology throughout his lifetime[,] he wrote no distinct treatise on psychology" (Gouax 1972, 237). *See also* Hatfield 1992, 200 (noting that Kant "never developed a theoretical psychology of his own").

Sturm notes that prior to publication of the *Metaphysical Foundations* in 1786, Kant did not claim that psychology could not be a science (2001, 164). He observes that even by the time of the first *Critique*, Kant apparently thought there could be such a science, *see* ibid. (citing B 874), and, in a September 1785 letter, Kant "promise[d] that the *Metaphysical Foundations* [would] treat the metaphysical foundations of the 'doctrine of the soul' . . . in addition to that of matter" (ibid.) (citing 10: 406).[86] Sturm reasons from this that "[i]t is . . . clear that Kant changed his mind with regard to the scientific status of empirical psychology[,] and that he did so between September 1785 and the appearance of the *Metaphysical Foundations* in 1786" (ibid., 165). Accordingly, Sturm argues,

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mind-body interaction is ill-formed because rather than a "crude [substance] dualism," of mind versus body, we have instead the question of how one type of representations relates to another (1967, 605-06, discussing A 385-92).

[86] Note that in the *Prolegomena*, Kant asserted that a "universal natural science in the strict sense . . . would have to bring nature in general – whether pertaining to an object of the outer senses or of the inner sense (the objects of physics as well as psychology) – under universal laws," which implies of course the possibility that there are universal laws applicable to both outer and inner sense (4: 295). *Accord* Hatfield 1992, 218-19.

we are well-advised to treat with "caution" Kant's conclusions about psychology, given they occurred so suddenly.

Indeed, Sturm notes that Kant, up to the mid-1770s, was influenced by Baumgarten's views on psychology, as evinced by his (Kant's) anthropology lectures, and that he defined psychology as the "sum-total of inner perceptions under natural laws," in his 1798 *Anthropology from a Pragmatical Point of View* (2001, 176). Sturm argues this conception of psychology, which he calls "extreme introspectionism," is that which Kant meant to reject when he denied that psychology could be a science (ibid., 177). *Accord* Brook 2004, 6 (noting that Kant had a "lack of enthusiasm for introspection").

Kant's sometimes-openness to the possibility of a psychological science (of some sort) seems to be reflected in, for example, the first *Critique*, in the Architectonic of Pure Reason in the Doctrine of Method, which Sturm cites. In relevant part, Kant there divides "pure philosophy" into critique and metaphysics; metaphysics is further subdivided into speculative (nature) and practical (moral) (B 869). Metaphysics of nature contains two parts: transcendental philosophy and "physiology of pure reason," the latter of which (physiology) may be either "transcendent" (in which case it considers objects beyond possible experience) or "immanent" (in which case it considers nature as either (1) objects given to us in outer sense (*i.e.*, corporeal nature); or (2) objects of inner sense (*i.e.*, thinking nature), also referred to, respectively, as rational physics and rational psychology (B 874)). *See also* Hatfield 1992, 218 (summarizing Kant's Architectonic).

However, further in the Architectonic, Kant questioned where "empirical psychology" fits:

> [Empirical psychology] comes in where the proper (empirical) doctrine of nature must be put, namely, on the side of **applied** philosophy, for which pure philosophy contains the *a priori* principles, which must therefore be combined but never confused with the former. Empirical psychology must thus be entirely banned from metaphysics, and is already excluded by the idea of it. Nevertheless, in accord with the customary scholastic usage[,] one must still concede it a little place . . . in metaphysics . . .. (B 876-77).

Thus, Kant appears to have some limited sense in which rational, and even empirical, psychology is appropriate. As Hatfield notes, "Kant's contemporaries noticed that he included legitimate versions of rational and empirical psychology in his architectonic division of the sciences" in the first *Critique* (1992, 218 n.18). Consistent with this, Guyer and Wood observe that Kant's treatment of psychology in the Architectonic seems to supplement Kant's earlier rejection of rational psychology in the Dialectic—in the Architectonic, as Guyer and Wood read it, Kant suggests that there are *a priori* grounds for "empirical judgments in . . . psychology" other than those Kant disavowed in the Dialectic (1998, 756 n.48).

To determine whether, and to what extent, Kant engaged in, or rejected psychology, the appropriate starting place is, as Hatfield suggests, to pick out a "domain of subject-matter as psychological and . . . consider whether the target items belong to that domain" (1995, 213).

2. Inner Sense and Outer Sense

It is often supposed, with good reason, that the object of psychology, for Kant, was inner sense. *See*, *e.g.*, Gouax 1972, 239. Inner sense ostensibly consists in mental phenomena, such as thoughts. This stands to reason from Kant's own distinction in the *Metaphysical Foundations* between physics and psychology, that is, the study of outer and inner sense, respectively, which correspond, again respectively, to extended and thinking nature. In line with this, Makkreel describes "inner sense [as] conceived [as] providing introspective access to feelings and other mental states" (2001, 186). This makes sense in context of Kant's first major reason against psychology as a science—*i.e.*, that the objects of psychology (namely, inner sense) are not mathematizable because they are not in space, but only time (which is another way of saying that the *a priori* form of inner sense is time, not space, and so mathematical principles do not apply to inner sense). Gouax concludes that, "[c]learly, then, Kant's emphasis on outer sense, because of his interest in physical science, precludes the possibility of a science of the inner sense" (1972, 240-41).[87] Thus:

> The psychologist, by means of the empirical rule of association, observes his thoughts, feelings, desires, resolutions, and other states as appearances of inner sense and looks for associated or correlated appearances. By discovering associations of appearances in inner sense, in terms of the three temporal modes of relation, [*i.e.*, duration, succession, and coexistence,] the psychologist formulates empirical laws based on the content of inner sense (ibid., 241).

Gouax's conclusion is consistent with Kant's assertion in the *Metaphysical Foundations* that psychology cannot be a "proper" science, but must rather content itself with being a body of systematically ordered facts.

[87] Gouax cites as support Kant's pronouncement in the first *Critique* that "the representations of *outer sense* constitute the proper material with which we occupy our mind" (1972, 241).

Thus far, we have established that Kant rejected some versions of rational psychology; he also rejected the possibility of psychology as a science insofar as its object of study is inner sense. However, we should note that inner sense is not the only specie of mental phenomena—outer sense consists in mental representations of external objects. Hatfield, for example, notes that Kant's distinction between inner and outer sense is a scholastic distinction, "adopted by Baumgarten, between external senses such as touch and vision[,] and internal sense directed toward states of the mind itself" (1995, 2010). Therefore, if outer sense can be the object of a proper natural science, then a subset of mental phenomena (representations of outer sense) can perhaps be the object of proper natural science, which opens the door to a science of psychology.

We know from the discussion above that Kant rejected "rational psychology" as a study of the "soul." To turn to inner/outer sense: if we understand "psychology" to encompass the study of mental phenomena, including inner and outer sense, then psychology would be incapable of constituting a science insofar as it includes the study of inner sense. However, the question remains whether, for Kant, psychology, to the extent that it focuses on outer sense, could be a science. *See, e.g.*, Mischel 1967, 605-06 (outer sense is a type of mental representation); McDonough 1995, 204 (citing Kitcher 1987 and noting that according to Kitcher, Kant was "doing psychology despite himself"); Hatfield 1995, 200, 209-10 (recognizing a dispute in Kant scholarship on the question of the extent to which Kant "rested his arguments on psychological ground[s],” and controversy about whether Kant’s psychology was in fact empirical (despite his protestations), transcendental, or noumenal).[88]

As for inner sense, it is generally acknowledged that Kant’s most extensive treatment of it, as an improper science, so to speak, occurs in his *Anthropology*, where he takes a “pragmatic” approach to the analysis of human conduct rooted in “travel, history, biography, novels,” and so on, as opposed to introspection, which Kant rejected as an unreliable method of inquiry (Mischel 1967, 621). *See also* Makkreel 2001, 192 (arguing that Kant “wants to replace psychology as an academic natural science with anthropology as a pragmatic cultural science”); Sturm 2001, 174 (noting that Kant, in his anthropology lectures, argued against introspection as a method of observing psychological phenomena); Brook 2007, 121 (identifying introspection as Kant’s target for criticism when referring to “psychology”).[89] However, inner sense, for the reasons stated above, is outside the scope of the present inquiry. Therefore, we return to outer sense.

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[88] Hatfield identifies four apparently psychological features of the first *Critique*: “(1) the division of the mind into cognitive faculties . . .; the positing of apparently innate mental structures, such as the forms of intuition or the categories; (3) the appeal to mental activities such as synthesis . . .; and (4) the apparent appeal to introspection in establishing the existence of [synthesis] . . .” (1995, 212). Hatfield concludes is that Kant’s subject-matter was epistemology and his arguments transcendental, rather than psychological (1995, 213-14).

[89] While the present chapter will focus on Kant’s treatment of outer sense to demonstrate that Kant engages in psychology, it should be noted that Kant’s rejection of the study of inner sense is not beyond reproach; far from it. As Mischel acknowledges, “[l]ooking back from our vantage point in history, it is easy to say that Kant mistook the framework of Newtonian mechanics for the only possible framework of science[,] and so tried to anchor its principles in the human understand as such,” which was a “widely shared” view during Kant’s time (1967, 604). Analysis of which of Kant’s objections to the study of inner sense have merit, and which have been refuted over time is a worthwhile project outside the scope of this dissertation. *Cf*. Mischel 1967, 616 n.14 (noting that

As noted above, outer sense consists of mental representations of external objects. *See* Hatfield (1995, 2010) (noting that Kant's distinction between inner and outer sense is a scholastic distinction, "adopted by Baumgarten, between external senses such as touch and vision[,] and internal sense directed toward states of the mind itself"); Mischel 1967, 605-606 (outer sense is a type of mental representation); Kitcher (1987, 227) (noting that outer sense gives rise to spatial representations). In Kant's own words: "***By means of outer sense (a property of our mind), we represent to ourselves objects as outside us, and as in all space***, and all as in space" (B 37) (emphasis added). Note that in this passage, outer sense, through which the mind receives sensory information for the synthesis of mental representations of external objects, is distinguished from inner sense, through which "the mind intuits itself" (ibid.).

Nayak and Sotnak argue there is an apparent paradox in Kant's treatment of psychology. For example, in Anticipations of Perception in the first *Critique* (concerning qualities), Kant seems to assert that sensible qualities are measurable, which would therefore make them mathematizable, and, therefore, a proper object of scientific inquiry (1995, 133-34). This would of course contradict Kant's many pronouncements in the *Metaphysical Foundations* that psychology is not a science because it cannot be mathematized.

Nayak and Sotnak resolve this apparent inconsistency as follows. They give two conditions for what they term "cardinal measurability": (1) orderability (*i.e.*, the ability of a magnitude to be compared as more or less, or longer or

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"commentators have found great difficulty in finding a consistent interpretation of Kant's views on inner sense").

shorter, than another magnitude); and (2) the capacity to be additive (*i.e.* a scale of measurement) (1995, 137-38). Qualities can be mathematized, that is, be capable of cardinal measurability, if we "represent the quality by means of a quantity" and fix a scale, for example, by assigning one degree (of warmth) a unit of "1 mm. length of mercury in [a] column" (1995, 143). If this is the case, then, Nayak and Sotnak conclude, "it is clear that qualities can be the subject of rigorous scientific study" (because they are mathematizable) (ibid., 144). In this case, what we might call "psychology," insofar as it is the study of sensory qualities, could be a science even according to Kant's criteria (ibid., 144) (as distinct from the study of the psyche or "psychological processes," AKA inner sense). *See also* Sturm 2001, 167-68 (agreeing with Nayak and Sotnak to the extent that they argue Kant allows for the application of some mathematics to "our own perceptions" including intensive magnitudes).[90]

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[90] Notwithstanding the possibility of mathematizing outer sense, Nayak and Sotnak ultimately conclude psychology cannot be a science for Kant because it cannot satisfy Kant's stringent "criteria for lawlikeness" (1995, 147). Hatfield also questions whether psychology could "discover mathematical laws through empirical research," but reasons that, nonetheless, psychology still could not constitute a science because it would lack universality and necessity, and methodological impediments would continue to hinder psychological scientific inquiry (1995, 221).

Sturm disagrees with Nayak and Sotnak's conclusion that Kant generally rejects psychology as a science because it cannot be mathematized; rather, Sturm, argues, Kant rejects the specific possibility of applying geometry to psychological phenomena (rather than all mathematics), which is enough to preclude psychology from constituting a science (2001, 164). More specifically, according to Sturm, objects of natural science must be mathematizable in a way that accommodates causal explanations using attractive and repulsive forces; because inner sense is incapable of being mathematized in such a way, it cannot be a science (ibid., 179). Interestingly, Sturm questions whether psychological phenomena, insofar as they manifest behaviorally in outer experience, may be mathematizable (ibid., 180).

The foregoing shows that Kant uses “empirical” and “rational” psychology in distinct ways, and contradictions manifest if we are not attentive to what Kant is referring when he employs one of these labels. Rational psychology is ruled out by virtue of the Transcendental Dialectic insofar as it seeks to discover truths about the soul. Rational psychology insofar as it rests on *a priori* principles, however, appears to be permissible. Empirical psychology, to the extent that it relies on introspectionism or focuses on inner sense, is off limits. However, empirical psychology in insofar as it focuses on outer sense is not ruled out.

Based on the above, we can carve out a limited domain of psychology that could very well be acceptable to Kant, as follows: the metaphysical foundations of psychology would share the same quadripartite structure as the metaphysical foundations of physics; and the domain of the empirical science of psychology would be limited to the psychological phenomena of outer sense, treating not the objects of intuition (as in physics), but the intuitions (representations of spatial objects) themselves.

Kitcher observes that Marr’s work on a computational approach to visual representation is “strongly Kantian in spirit” (1987, 243 n. 62), and I believe that work on the question of how the mind constructs 3D representations of shapes from information “encoded in images, for example by stereopsis, shading, texture, contours, or visual motion[] due to a shape’s local surface properties” can potentially yield the mathematization for outer sense that Kant requires for any proper science. *See*, e.g., Marr 1982/2010, 36-38. Whether, and how, a computational approach can satisfy Kant’s mathematization requirement warrants further investigation.

3. A Blueprint for Constructing the Metaphysical Foundations of Psychology

Before delving into what a metaphysical foundation of psychology might look like, it would be prudent to address the elephant in the room, namely, the relation of Kant's transcendental philosophy to empirical work. We saw in the last chapter that, for Kant, a proper science is not one that is entirely *a priori*, but, rather, one that has an *a priori* foundation from which we can discern certain necessary principles which undergird our empirical investigation of the objects of inquiry. This constitutes a stronger tie between Kant's transcendental arguments and empirical inquiry than is often dared. Allais, for example, makes the weaker and more conservative claim that "[Kant's] *a priori* argument for the need for a form to order the input of sensation in order for us to be given objects in intuition is compatible with the results of empirical investigation into how the brain actually does this" (2017, 29). Gomes, similarly, argues that Kant's transcendental idealism is merely consistent with empirical research into the mind:

> Empirical psychology concerns human beings as they are subject to empirical, causal laws, some of which concern the workings of the human mind. Although Kant holds that knowledge of such laws cannot amount to a proper science in virtue of falling short of strict universality (MFNS 4:471), this is nevertheless compatible with our pursing empirically grounded investigation into the structure and workings of the human mind in its empirical setting (2017, 15).

Dunlop makes a slightly stronger claim about the relation between transcendental idealism and empirical research:

> To be sure, the conclusion of a transcendental argument could never be empirically proved or refuted. But by showing how an alleged necessary condition is in fact satisfied, in minds of our sort, empirical findings can increase the explanatory power of a

> transcendental argument's conclusion, and thus show the argument to be more adequate to its goal (2017, 50).

While it seems plausible that a transcendental argument cannot be empirically proven—given the point of a transcendental argument is that its necessity does not derive from empirical observation—it is questionable whether a transcendental argument can be refuted.

Reichenbach argued that the development of non-Euclidean geometry basically falsified Kant's claims in his philosophy of space (that is, the necessity of Euclidean geometry) (1958, 36), and Friedman likewise concluded that the *a priori* has two senses: (1) necessary unrevisability; and (2) constitution of the objects of scientific knowledge—and that these two senses are severable such that we should take *a priori* propositions to be "relativized" and in light of contemporary "developments in scientific philosophy" (2017, 213). While there could be some question about whether Kant's transcendental claims are refuted by further *a priori* mathematical developments, it bears noting that general relativity calls into question the necessary applicability of Euclidean geometry; and why we prefer general relativity to Newtonian mechanics is because general relativity is more accurate than Newtonian mechanics.[91] Thus, the preference for

[91] *See* Reichenbach 1958, 36-37 (noting that "[o]nly Einstein's theory of gravitation predicted the non-Euclidean result which was confirmed by astronomical observations," and "it is determined through objective reality alone which is the actual geometry"). Pagels notes that if space-time is curved, then the geometry of space is best described by non-Euclidean (specifically Riemannian) geometry (1982, 47). Einstein's general theory of relativity provides that gravity is "the curvature of space," that is, "matter changes the geometry of space from flat to curved in its vicinity" (ibid., 48). So if the general theory of relativity is true, then space is non-Euclidean. This is an empirical question. Einstein devised three tests for determining whether his theory was true; if true, we should expect to find: "(1) a slight bending of light in the gravitational field of the

general relativity ultimately derives from empirical observations; accordingly, it would seem that some *a priori* arguments can in fact be refuted based, in part, on empirical observations, even if they can never be proven, *per se*.[92]

The foregoing suggests that we can consider empirical work for the purpose of corroborating, and even building on, the *a priori* foundations Kant provided in the first *Critique* and *Metaphysical Foundations*, consistent with Kant's views about proper science. We can consider empirical work, in principle, without any contradiction with Kant's philosophy; we can increase the explanatory power of Kant's transcendental arguments should we find they are empirically instantiated; and, it seems, we could even refute *a priori* principles insofar as they seem to be inconsistent with empirical evidence.

Before moving on to the work of sketching a metaphysical foundations of psychology, a brief word about what the metaphysical foundations of psychology is *not*: The concept of binding is sometimes taken to be the contemporary analogue to Kant's views on the mind, specifically how the mind orders sensory material into representations of particular objects.[93] Dunlop, however, notes that theories about binding tend to focus on the neurophysiological mechanisms underlying our mental capacity to have perceptual experiences, and, therefore,

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sun, (2) a small shift in the orbit of the planet Mercury, and (3) clocks should run slower in a gravity field" (ibid.). All three of these tests confirmed that general relativity is true. *See* ibid. at 49-53.

[92] *But see*, *e.g.*, Allison 2004, 116-18 for an opposing view, namely, an argument that Kant's transcendental idealism does not hinge on the truth or falsity of Kant's beliefs about geometry (*contra* Friedman).

[93] *See* Allais 2017, 29-30.

binding cannot be a stand-in for Kant's transcendental analysis (2017, 51). Dunlop additionally argues that the visual objects binding produces are not objects in the ordinary sense, but rather any collection of properties which have boundaries, which is too broad of a class, given it would encompass things such as "dots on screens . . . shadows, parts of physical objects, ripples on water, and patches of reflected light" (ibid., 52) (internal citation and quotations omitted). Crediting Dunlop's point about the unsuitability of binding as a contemporary proxy for Kant's transcendental psychology—based specifically on binding's typical focus on neurophysiological mechanisms—the next step is to move on from binding to a different, more suitable framework.

Recall from the last chapter that the metaphysical foundations of any proper science must accord with the categories, which are: (1) quantity (unity/plurality/totality); (2) quality (reality/negation/limitation); (3) relation (inherence and subsistence/causality and dependence/community); and (4) modality (possibility/existence/necessity) (B 106).[94] The next step, analogously with the *Metaphysical Foundations*, is to construct corresponding *a priori* principles applicable to the object of inquiry, in this case, outer sense (*i.e.*, representations of objects).

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[94] Recall, additionally, that the table of principles, contains "rules of the objective use of the categories" (B 200). The principles of understanding include the following: (1) Axioms of Intuition; (2) Anticipations of Perception; (3) Analogies of Experience; and (4) Postulates of Empirical Thinking (ibid.). Recall that the Axioms of Intuition pertain to extension in space (B 202, 204); the Anticipations of Perception provide that objects cause some degree of sensations in perceivers (B 207 – 211); and the Analogies of Experience consist of rules, including: substance persists over time and change occurs through causation (B 218, 224, 232). As noted in the previous chapter, the category of modality corresponds to the Postulates.

There is empirical work being undertaken that seems to do just this. Spelke has been working for decades on infant perception, and has recently, in her "magnum opus" (Bliss 2022), synopsized thirty-five years of her, and her colleagues', work on what she calls "core knowledge of objects" exhibited by infants as young as two months old.[95] We can begin with the macro view and descend into the details.

As an initial matter: recall the argument from above that Kant's criticisms of psychology as a science were directed at a specific type of psychological methodology, namely, introspectionism. Spelke contends that one of the things that distinguishes core knowledge from perception and belief is that perceptions and beliefs rely "in part on unconscious processes[,] but give rise to conscious experience, whereas core knowledge is wholly unconscious: *We can become aware of its existence and properties by doing experiments but not by*

[95] While Spelke has been described as a "legendary cognitive scientist" (Hamlin 2024), her magnum opus *What Babies Know* has not gone without criticism—for example, it has been argued that she problematically downplays "learning" that occurs as early as the embryonic stage of human development (Moore and Lewkowicz 2024). Spelke, in a subsequent defense of her work, disputed the utility of Moore and Lewkowicz's proposed definition of "learning" because it is so broad as to be unhelpful for guiding research, though she acknowledged some points of unclarity in *What Babies Know*, such as her definition of "innate," which she later refined to mean "present and functional on the infant's first effective *informational* . . . encounters with the entities to which it applies" (2024) (emphasis in original). That said, her critics tend to acknowledge the book as a "scholarly presentation of core knowledge theory and a masterful compendium of [the] empirical evidence that supports it" (Moore and Lewkowicz 2024). *See also* Gweon and Zhu 2024 (describing Spelke's work as a "masterful synthesis of what we have discovered about the origins of human intelligence"). Unfortunately, evaluation of the merits of criticisms of Spelke's work is outside the scope of this project, but it must be acknowledged that it is not without detractors.

introspecting" (2024) (emphasis added).[96] This is a crucial point because it shows that core knowledge does not rely on introspection, and therefore does not rely on a method Kant disclaimed.

A further parallel includes Spelke's hypothesis that core knowledge is "hard-wired," (2024), that is, it is a condition precedent for experience as we know it. As Dunlop rightly observes:

> . . . [H]uman infants would seem indisputably to fall within the scope of the first *Critique*'s theory of cognition, since they possess both human sensibility and a faculty of understanding. (Of course, insofar as they do not yet use concepts, their understanding has not yet been 'awakened into exercise' (B1).) Thus whatever can be inferred (from their behavior) about the necessary conditions on infant representation has a strong claim to describe the form of a human cognitive faculty (2017, 56).

In other words, necessary conditions manifest in infant representation can justifiably be taken to manifest the forms of human cognition.[97]

Spelke describes core knowledge—the details of which are discussed below—as being "innate." It is important to note that notwithstanding Spelke's use of the term "innate," there is no conflict with Kant's rejection of innate representation. Spelke, in defense of the term, notes that there has been

[96] Consistent with this, Brook observes that contemporary psychology, insofar as it focuses on behavior and the "causal context of behavior," is more akin to what Kant would consider anthropology; indeed, Brook notes, "Kant's rejection of introspection and turn to behavior has a very contemporary feel to them" (2007, 121-22). That is, to understand, *inter alia*, behavior, "we must know something of the powers and faculties of the human mind" (ibid., 122). That said, Brook concludes that "[s]trangely enough, Kant never seems to have asked whether anthropology in his sense could be a science" (ibid.).

[97] It should be noted that while Dunlop and I agree on this point, her conclusions and the ones herein— about whether infant representation instantiates Kant's categories—are at odds.

confusion about whether core object knowledge is "innate" due to the following three types of conflation about its definition: (1) innateness requires a known biological basis; (2) innateness is inconsistent with emergence; that is, that if an ability is innate, it must be present at birth; and (3) innate abilities cannot be affected by learning (2022, 71). To the contrary, Spelke acknowledges core knowledge need not be present at birth but could be emergent and affected by learning—and yet it may nevertheless still describe the necessary forms of human cognition, and, as such, it is a condition precedent for experience.

To see that there is no conflict with Kant on this point, consider the following. Kant apparently rejects the possibility of "innate" representations, including forms of intuition and the categories, which appears, initially, to be inconsistent with Spelke's hypothesis about the "innateness" of core knowledge. However, Kant's view is more nuanced. To illustrate, it is worth citing at length a passage from his 1790 essay *On a Discovery Whereby Any New Critique of Pure Reason is to be Made Superfluous by an Older One*:

> ***The Critique admits absolutely no implanted or innate representations***. One and all, whether they belong to intuition or to concepts of the understanding, it considers them as acquired. ***But there is also an original acquisition . . . of that which previously did not yet exist at all, and so did not belong to anything prior to this act. According to the Critique, these are, in the first place, the form of things in space and time, second, the synthetic unity of the manifold in concepts; for neither of these does our cognitive faculty get from objects as given therein in-themselves, rather it brings them about, a priori, out of itself. There must indeed be a ground for it in the subject, however, which makes it possible that these representations can arise in this and no other manner, and be related to objects which are not yet given, and this ground at least is innate.***

* * * *

> ***The ground of the possibility of sensory intuition*** is neither of the two, neither limit of the cognitive faculty nor image; ***it is the mere receptivity peculiar to the mind,*** when it is affected by something (in sensation), to receive a representation in accordance with its subjective constitution. Only this first formal ground, e.g., of the possibility of an intuition of space, is innate, not the spatial representation itself. For impressions would always be required in order to determine the cognitive faculty to the representation of an object (which is always a specific act) in the first place. ***Thus arises the formal intuition called space, as an originally acquired representation (the form of outer objects in general), the ground of which (as mere receptivity) is nevertheless innate, and whose acquisition long precedes the determinate concepts of things that are in accordance with this form; the acquisition of the latter is an acquisitio derivativa, in that it already presupposes universal transcendental concepts of the understanding, which are likewise acquired and not innate, though their acquisitio, like that of space, is no less originaria and presupposes nothing innate save the subjective conditions of the spontaneity of thought (in conformity with the unity of apperception).*** No one can be in doubt as to this meaning of the ground of the possibility of a pure sensory intuition, save someone who may be leafing through the *Critique* with the help of a dictionary, but has not thought it through.

(8: 221-223) (emphases added). What the foregoing shows is that though Kant rejects the possibility of innate representations, he does not reject all innateness. He says that the two human faculties, receptivity and spontaneity are innate and serve as the grounds for spatial representation and conceptualization, respectively. Crucially, while the pure forms of space and time—and the categories— are not innate, they are what Kant terms "originally" acquired, and "previously did not yet exist at all, and so did not belong to anything prior to this act"; that is, the mind "brings them about, a priori, out of itself."

In sum, it appears that the categories are not "innate," *per se*, because they only come about *via* activity of the understanding—however, the categories necessarily emerge from something innate in us, that is, our spontaneity. Frierson makes a similar point when he observes that sense impressions "prompt an activity of the understanding," which causes us to experience objects in, for example, causal relations with one another, after which humans can "abstract from these experiences to become aware of a concept of causation that makes them possible" (2014, 106). However, Frierson goes on to say, even if explicit cognition of the categories occurs after experience and abstraction from experience, "a priori concepts ***can arise with no other content than what is due to one's innate cognitive power***. For such concepts, one merely reads off from one's experience what one has already – by means of the form of the understanding itself – put into it" (ibid., 107) (emphasis added).[98] So, the categories are not innate because they are only activated once spontaneity acts on receptivity—***but*** the categories arise from something innate, namely our spontaneity. Thus, while there is an apparent conflict between Kant and Spelke insofar as she claims that core knowledge is "innate," there is no necessary conflict between them beyond terminology, given both agree that the categories, or core knowledge, respectively, may be emergent and derive from our "innate" makeup.

[98] Kitcher observes that while Kant expressly argued in his pre-Critical *Inaugural Dissertation* that the mind has "stable and innate laws," he moved away from "innateness" in the first *Critique* (1987, 218-19). Kitcher argues, in essence, that Kant presents a functionalist view of the mind in the *Critique* (ibid., 214)—that is, the human mind's production of intuitions could be realized by one or possibly more mental operations; and multiple realizability militates against one innate process (or mental operation) for the production of intuitions (or the imposition of form on sensation) (ibid., 219).

But why would Kant draw a distinction between the categories being themselves innate and emerging from something innate, *i.e.*, our faculty of spontaneity? Hatfield notes that the “central arguments” of the first *Critique* include “the positing of apparently innate mental structures, such as the forms of intuition or the categories” (1992, 212). However, he goes on to claim that Kant rejects claims of innateness of the categories because “such an argument could only support an empirical claim about the psychological development of an individual; it could not establish that the categories are necessary for determining the synthesis required by the unity of apperception” (ibid., 215). So it is plausible that Kant rejects innateness for the categories specifically because that would only contingently establish their applicability, when he desires to show not just the actuality (*i.e.*, the “innateness”) of the categories, but their necessity (viz., that experience necessarily presupposes them).

One may worry that Kant has taken the contingency out of the categories and relocated it down a level to the nature of our “innate” faculties of receptivity and spontaneity. But I think this is exactly what Kant does. For example, in the *Critique of the Power of Judgment*, Kant states, “I cannot presuppose that in every such being thinking and intuiting . . . are two different conditions for the exercise of its cognitive faculties” (5: 402). That is, Kant admits of the possibility of beings with different cognitive faculties, meaning spontaneity and receptivity, as two complementary faculties of human cognition, do not necessarily apply to all types of beings. We also see this manifest in the first *Critique*, specifically in the Transcendental Deduction, where Kant addresses the question of why our understanding functions the way it does: “But for the peculiarity of our understanding, that it is able to bring about the unity of apperception *a priori* only by means of the categories . . ., a further ground may be offered just as little as one can be offered for why we have precisely these and no other functions for judgment or for why space and time are the sole forms of our possible intuition" (B 145-46). In other words, it seems to be a brute (and contingent) fact that we have the faculties we have (*i.e.*, receptivity and spontaneity)—but given that we do, they must necessarily function in certain ways.[99]

This Kantian hypothesis—about the relationship between our cognition and our faculties of cognition—is a subtle one, and it gives rise to a conceptual approach that is useful for guiding psychological research. To explain: As noted above, Kant is often taken to be either an early proponent of functionalism or a proto-functionalist.[100] However, one component of the functionalist view is multiple realizability; that is, the usual functionalist emphasis is on the cognitive functions performed by a subject rather than the implementation (or physical, constitution, or realization) of the thing performing the cognitive functions. *See, e.g.*, Kitcher 1987, 214; Brook 2007, 124 (arguing that "Kant's approach to the mind is centered on how it works, as opposed, for example to how such a system

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[99] I do not think Kant's acknowledgement of the contingency of our cognitive faculties is problematic because it is consistent with fundamental tenets of Kant's transcendental idealism, specifically, his Copernican revolution, that is, that any necessity to be found in the world derives from human cognition, as discussed *supra* chapter 1. This does not require that human cognition be the only game in town (viz., that all cognition must necessarily function in the way human cognition functions). That said, given the nuances in Kant's view on innateness, it is certainly excusable if some scholarship refers to him as having an "extreme innatism about central cognitive capacities of the mind" (Brook 2004, 2 n.2).

[100] *See, e.g.*, *supra* at pp. 95-97 and 118 n.98.

might be physically constituted"). What the foregoing discussion of innateness shows is that while Kant is certainly concerned primarily with how the mind functions, he nevertheless recognizes that our cognitive functions are grounded in our specific constitution as beings who have receptivity and spontaneity.[101] While Kant makes this specific observation in his discussion of our innate faculties, we also see this same point reflected in the *Metaphysical Foundations*, where he argues that we should take motion to be the fundamental characteristic of matter, because it is through motion that objects affect our senses (4: 476). Thus, Kant (albeit somewhat indirectly) acknowledges the inextricable link between our cognition and our "innate" faculties insofar as we have a faculty of receptivity—that is, of being sensorily affected by external objects through their communication with our sense organs via motion—and the faculty of spontaneity which acts in conjunction with receptivity. To reemphasize, however: strictly

[101] To the extent that there is doubt that Kant means to refer to human beings specifically, note that Kant contrasts human cognition with other sorts. For example in the *Critique of the Power of Judgment*, Kant argues that it is "absolutely necessary for the *human understanding* to distinguish between the possibility and the actuality of things," owing to "the subject and the nature of its cognitive faculties," *i.e.*, receptivity and spontaneity (5: 401-02) (emphasis added). Kant states there that "[f]or an understanding to which this distinction did not apply, all objects that I cognize would **be** (exist), and the possibility of some that did not exist . . . would not enter into the representation of such a being at all" (5: 403). This demonstrates that Kant is concerned specifically with human cognition, which, as stated above, arises in the human organism, which has faculties of receptivity and spontaneity. *See also*, *e.g.*, Winegar 2017, 1238-42 (providing an overview of an intuitive understanding as contrasted with the human discursive understanding). Additionally—while this is a complex subject appropriate for its own separate inquiry—note that there is evidence that Kant distinguishes human cognition of objects from non-human animals' mere "acquaintance" with objects via representations without concepts. *See*, *e.g.*, Onof 2016, 208-10 (discussing Kant's views on animal perception). The foregoing suggests that human cognition is Kant's concern rather than some general conditions of cognition applicable to any and all entities.

speaking, our pure intuitions (of space and time) and the categories are not innate; they are grounded *in* our innate powers of receptivity and spontaneity.

This is of continuing relevance to psychological research because it addresses a certain shortcoming some see in traditional functionalist approaches to the mind. To elaborate: as noted above, functionalists tend to focus on function to the exclusion of the physical things that realize those functions, on the assumption that many different physical systems could perform the same functions, and so the physical nature of the system is less important.[102] Marr's pioneering computational approach reflects this functionalist approach to a certain extent. His computational approach rested on a tripartite distinction between (1) computational theory (the high-level abstract question of what exactly is being computed); (2) representation and algorithm (assigning a representation for input and output and giving an algorithm for the transformation from input to output); and (3) hardware implementation (physical realization) (Marr 1982, 22-25). Marr argued that these levels are "only rather loosely related," and that one must "exercise extreme caution in making inferences from neurophysiological findings[, *i.e.*, the third level,] about the algorithms and representations being used, *particularly until one has a clear idea about what information needs to be represented and what processes need to be implemented*" (ibid., 25, 26) (emphasis added). This demonstrates a conceptual framework in which the levels of understanding of perception are

[102] *See*, *e.g.*, Kim 2002, 135 (discussing multiple realization and observing that it is "widely accepted by philosophers, especially those who are inclined to favor the functionalist line on mentality").

loosely related, and the function abstracted from, and privileged above, the implementation.

Marshall observes, consistently with this, that Marr's framework arguably privileges the representational/algorithmic level of explanation, and this has "prevented the emergence of more integrative accounts of mental life"; additionally this framework fails to provide a "clear formulation of how to conceptualize the relations between levels" of explanation (2014, 1). More specifically, Marshall criticizes the computational approach to vision for isolating information processing (the second level of understanding) from embodiment (the third level of understanding), given the algorithms needed to perform our higher level tasks are informed by the bodies implementing those algorithms (ibid., 2). Accordingly, he argues, we should take a more critical approach to the "tidy separation of levels," and, further, attempt to better understand the relationship between the levels. Insofar as a functionalist approach has viewed the representational/algorithmic level in isolation from embodiment—and has therefore failed to yield much progress in understanding the interaction of brain/body/mind—a conceptual framework that recognizes the dependence of our cognitive functions on our faculties of spontaneity and receptivity support a research program that moves away from a strictly computational approach and more toward an embodied one, in which we acknowledge that our pure intuitions and the categories—or the categories' more contemporary counterpart, core knowledge, discussed further below—emerge from the faculties of the specific organism at issue, *i.e.*, embodied beings.[103] If our faculty of receptivity (*i.e.*, sensibility) in part grounds our cognitions, then to fully understand our cognitions, we need to understand the role receptivity plays in the formation of cognitions, which requires an investigation into how receptivity functions, which pertains to the third level of understanding, *i.e.*, physical implementation.[104]

In sum: an approach to the representational/algorithmic level of understanding our perceptions and cognitions—isolated from the other levels of understanding—is going to yield an incomplete picture of how the human organism functions. However, a Kantian framework—because of its recognition that our cognitive rules are grounded in our innate faculties—can assist in pulling back from a computational or functionalist approach that "place[s] a

[103] There is perhaps some irony in arguing that Kant supports an embodied approach to cognition, because that view is not patent in the first *Critique*; however, I believe the discussion above regarding Kant's views on the relation between, on the one hand, pure intuitions and the categories, and, on the other hand, our faculties of receptivity and spontaneity, support this interpretation. *Cf.* Merleau-Ponty 2008, 120 (suggesting that Kant fails to recognize that our body is the medium through which we engage with the world, and arguing that we should, to the contrary, acknowledge our embodiment, rather than "envisaging my body or my surrounding as objects in the Kantian sense, that is, as systems of qualities linked by some intelligible law . . ..").

[104] I suggested above (*see supra* p. 108-09 n.90) that Marr's computational approach may be promising for realizing Kant's mathematization requirement for science (in this case, the science of outer sense, viz., perception). Notwithstanding the potential shortcomings of a computational approach, just discussed, I reiterate that the computational approach may nevertheless be useful for a Kantian approach to perception, even if the two frameworks are not identical.

discontinuity at the intersection of psychology and neuroscience . . ." (Marshall 2009, 115).[105]

In any event, notwithstanding what I argue is Kant's acknowledgement of the interdependence of the various levels of understanding perception and cognition, it is certainly the case that the discussion in the first *Critique* of how the understanding functions is akin to Marr's first and second levels of understanding, and it is to the categories and their contemporary successor, core knowledge, that we return. According to Spelke,

> . . . [r]esearch on infants' representations of objects provides evidence for a core cognitive system with four properties. First, it is unitary: It serves to represent entities with the interconnected, abstract properties that apply to all material, movable, inanimate bodies: *cohesion*, *spatiotemporal continuity*, *solidity*, and *action on contact* (2022, 81) (emphasis added).

Additionally, evidence suggests that the "core cognitive system" emerges in infanthood and persists through human adulthood; it "supports infants' exploration and learning about particular kinds of objects and their interactions,

[105] This is not to say that Kant saw it as his task or the task of philosophy to discern the specific nature of the grounding relationship between the faculties of spontaneity/receptivity and our cognition. Additionally, an emphasis on embodiment does not necessarily entail a reductionist framework, which I think Kant would be unlikely to endorse. *Compare*, *e.g.*, Marshall 2009 (arguing that embodiment defends against reduction of psychology to neuroscience) *with* 5: 400 (Kant arguing in the third *Critique* that "organized beings" cannot be explained in terms of more fundamental natural laws, and it would be "absurd . . . to hope that there may yet arise a Newton who could make comprehensible even the generation of a blade of grass according to natural laws that no intention has ordered . . ..").

at least by the end of the infancy period"; and the system possesses features of both perceptual and belief systems, seemingly situated between the two (ibid.).[106]

Relevant for our purposes are core knowledge's four "abstract properties": cohesion, spatiotemporal continuity, solidity, and action on contact. "Cohesion" is the property objects have of maintain[ing] both their connectedness and their boundaries as they move" (Spelke 2022, 46). Studies have shown, among other things, that infants have the capacity to perceive objects as having cohesive boundaries and can discern one object as being separate from another when they are separated in depth, but perceive two objects as connected when they are adjacent in depth (ibid., 45). Infants are further able to discern two objects when they move relative to each other, but when they move together, they are perceived as a connected body (ibid.). Cohesion thus can be seen as a correlate for the first category of quantity insofar as infants have the rudimentary capacity to discern one object from another based on boundaries and motion, that is, the motion of extended bodies in space.

Next, we take "action on contact," that is, causality. Spelke notes that "[a]cross many studies, infants' patterns of looking at colliding objects provide evidence that they appreciate that inanimate objects undergo abrupt changes in motion when and only when they come into contact" (2022, 58) (internal citation omitted). That is, infants have been shown to expect "changes in two objects' motion [will] occur on contact," though infants are "slow to master the distinctive

[106] Baillargeon, influenced by Spelke, argues that continuity and cohesion (and subordinate principles including solidity and boundedness) are "corollaries of a single and more powerful principle of persistence, which states that objects persist, as they are, in time and space" (2006, 2).

mechanical properties of objects that differ in mass or mass distribution" (ibid. 59). So, while infants expect two colliding objects to result in motion, they do not apprehend that heavier objects require more force to displace, for example; and "young infants show no consistent responses to events in which an object's behavior fails to accord with gravity or inertia" (ibid.). Action on contact thus shows that even in infancy, humans are equipped with the basic view that objects are subject to causal relations with one another, which corresponds to the third category of relation.

Studies also show continuity, *i.e.*, that, for infants, "objects persist over occlusion and move on connected paths through space and over time" (Spelke 2022, 54). For example, infants watched a rotating screen until they became "habituated" to it, and then researchers placed an object behind the screen, on the theory that if the infants had object permanence, they would expect that the screen to stop rotating at the point where the object was placed; if they did not have object permanence, they would have no such expectation. Studies showed "that infants expected the screen to stop moving when it arrived at the object that stood behind it" (ibid., 50).[107] Indeed, a "rich series of studies" on the matter

[107] Infants looked longer at the screen that "moved freely through the space that the now-hidden object occupied," suggesting that there was something unexpected about these circumstances, *i.e.*, that they contravened the infants' expectations (Spelke 2022, 50). Dunlop argues that infants who observe an object disappear behind an occlusion and then shift their attention to the other side of the occlusion could demonstrate either continuity (that is, the expectation that the object continues to exist and move) or rather just an extrapolation from disappearance to reappearance without any belief in the persistence of the hidden object's existence. Because there are two explanations, Dunlop reasons that continuity does not establish infants have beliefs about objects' continued existence (2017, 61). From there, Dunlop reasons that core knowledge of objects (which she calls, consistently with the literature, the "primitive representation of

shows that infants' "apprehension of objects depends on mechanisms that extend beyond perception," and that they are aware of the existence of objects they "no longer see" (ibid., 51). This shows that infants apply the category of modality, *i.e.*, that objects they have observed to exist (*i.e.*, that have actuality) do not blink out of existence (or lose their actuality) simply because they are out of sight.[108]

Last is the category of quality. This one is more difficult because, per the Anticipations of Perception, quality concerns intensive magnitudes, that is, the

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objects") is not "tantamount to the application of the category of substance" (ibid.). This conclusion is doubtful because the other studies discussed above suggest that in fact infants do exhibit belief about the continued existence of objects that are occluded.

Dunlop also argues the categories do not apply to core object knowledge because the latter does not supply infants with objects' "causal nature and history," that is, it does not supply adequate constraints about how objects behave causally, and therefore, allows for such possibilities as spontaneous changes in an object's properties (which are in fact impossible) (2017, 65-66). While it is true that infants have a limited ability to apply continuity to objects based on the objects' properties, that does not negate the ample evidence that infants do in fact apprehend causality between objects; all this shows is that infants have not mastered the specific causal laws and relations that obtain in the world—it does not show that infants are unable to perceive object relations in accordance with general causal principles. *See*, *e.g.*, Spelke 2022, 52-53 (noting that infants were able to "track object identity by spatiotemporal information[, *i.e.* motion,] even when they fail to track object identity in accord with object properties and functions").

[108] It must be acknowledged that infants' detection of, for example, continuity violations is imperfect (Baillargeon 2008, 3). This, however, does not rule out the possibility of core knowledge, or innate principles; rather, it may simply be due to the infants' failure to incorporate applicable information into their representations. For example, seven-and-a-half-month olds were able to detect a color change violation (green ball is occluded and red ball revealed) following priming, specifically, the use of green cups to hammer pegs and red cups to pour salt, which, it is hypothesized, rendered the colors salient by associating them with different functions, which made the infants "more likely to include information about the green and red balls in their physical representation of the test event" (Baillargeon 2008, 9).

degree of sensation an object produces in a subject. However, infants' perception of qualities is complicated because, "[b]y themselves, . . . differences in color, texture, and form have little effect on young infants' perception of where objects begin and end" (2022, 46 n.3). That said, "differences in the colors, textures, and shapes of the objects call infants' attention to the boundaries between two objects . . ., foster infants' grouping of objects or forms into collections . . ., or modulate infants' perception of moving, occlude objects" (ibid.). So it is apparently not the case that infants have no discernible perceptions of qualities, but that their perceptions of qualities contribute to their ability to apprehend object unity and boundaries.

Thus all four categories have been shown in experimental contexts to be employed to a greater or lesser degree by infants, which certainly corroborates Kant's transcendental argument that these pure concepts are applied *a priori*.

But why should we think of core knowledge of objects is cognitive rather than due to subpersonal perceptual processes? Spelke's (and others') research shows that while the core object system shares some similarities with perceptual systems, it has much in common with higher order thought—for example: the core object system operates with the same constraints across sense modalities; it is active even when objects are occluded and therefore not the objects of direct perception; the same principles of the core object system are involved in both infant perception and reasoning about objects; and, lastly, the core object system "supports infants' efforts to explain the events that they perceive: a critical condition for learning new abstract concepts" (2022, 78-79).

Relatedly, Spelke suggests that core knowledge representations are both iconic and propositional, that is, that they combine iconic (imagistic) and discursive (or "language-like") elements, given they support learning and inferences (2024). Quilty-Dunn et al. have argued similarly, *i.e.*, that perception is both iconic and discursive—viz., that perception involves language-of-thought-like representations (2022, 2).[109] Quilty-Dunn et al. reason that if perception provides information for cognition, and cognition has a LoT structure, then the interface between perception and cognition likely requires some common elements (ibid., 5-6). Additionally, they show that empirical work on "object files" (that is, perceptual representations of individuals across time and space that are stored in visual working memory ("VWM")) suggests that object files have discrete constituents, role-filler independence, predicate-argument structure, and abstract conceptual content, which justifies considering them to be LoT-type representations (ibid., 6).

That object files have discrete constituents is shown by the fact that object files can separately lose information about objects such as color or orientation. The predicate-argument-like structure is demonstrated by subjects' abilities to maintain the identity of tracked objects notwithstanding that some of their

[109] Quilty-Dunn et al. identify six properties language of thought ("LoT") representations have, not all of which are necessary, and many of which cluster together (2022, 2). They have: (1) discrete constituents (i.e., a predicate can be separated from its subject and its other predicates); (2) role-filler independence ("independence between syntactic roles and the constituents that fill them"); (3) predicate-argument structure (predicates are applied and truth-evaluable, such as in the example "John smokes"); (4) logical operators (not, and, or, and so on); (5) "inferential promiscuity" (make possible inferences independent of natural language); and (6) abstract conceptual content (represents abstract categories) (2022, 3-4).

properties change or have been forgotten (ibid., 7). That object files include abstract conceptual information is suggested by, *inter alia*, studies showing that: infants notice when objects are occluded and then emerge as an object in a different category (e.g., a face versus a ball); infants, when shown familiar objects and unfamiliar objects, have an EEG signature of sustained attention for "across-category and within category changes for unfamiliar categories," but not for familiar categories; and adults "VWM seems often to discard specific sensory information in favor of conceptual-category-guided representations," such as object files being "biased toward the center of color categories" (ibid., 7-9).[110] Lastly, perceptual representations contain information about "structured relations," that is, the visual system represents a part-whole structure for objects (e.g., the different parts of a tree as constituting a whole), but it also discriminates relations between objects (e.g., distinguishes between occlusion and containment events, *i.e.*, one object disappearing behind, or inside, another object) (ibid., 9).

Thus, one indicium that we should regard the core object system as something cognitive is it guides infants' reasoning about objects in a way that is

[110] While preverbal children and non-human animals have been shown to engage in logical inference, which supports LoT, the evidence is mixed about whether infants and animals use logical operators. African gray parrots have been shown to reason using disjunctive syllogisms (e.g., via the "four-cup task," which involves determining which two of four cups contain rewards). While children as young as two and a half can perform a variant of the four-cup task, the two-cup task, they do not succeed at the four-cup task (Quilty-Dunn 2022, 13). Even though there are non-logical explanations for children's success at the two-cup task, children as young as twelve months' old show the same oculomotor signature as adults performing a disjunctive syllogistic task (i.e., their pupils dilate and their eyes dart to the still-hidden object), which "implicat[es] the same underlying computations" (ibid.).

reminiscent of how adults employ concepts: "Our concepts . . . carve the perceived world into entities whose existence is independent of our immediate perceptual experience, for the properties we attribute to those entities reflect the ways we believe they behave and relate to one another" (ibid., 79). This accords with McDowell, who, in arguing for the conceptuality of perception, described having concepts as having a "sensitivity to a kind of state of affairs in the world, something that can obtain anyway, independently of these perturbations in [one's] stream of consciousness" (1996, 12).

4. Conclusion

In sum, the foregoing demonstrates the possibility of constructing a Metaphysical Foundations of Psychology analogously to the method Kant employs in the *Metaphysical Foundations of Natural Science*. That is, taking the categories and the corresponding table of principles, as an *a priori* foundation, we can construct rules that govern representations of outer sense. And, while the categories and table of principles, due to their *a priori* nature, are not subject to empirical proof, *per se*, they can nevertheless be corroborated via empirical observation; and, just as with physical science, they can be mixed in with empirical data to construct a proper science. That said, a question that has yet to be explored herein—despite the sustained discussion of Kant's views on mental representations—is what impact Kant's transcendental idealism, specifically his Copernican revolution, has on his ontology; that is, should we take Kant to be a realist, anti-realist, or something in between vis-à-vis his views about the ontology of the objects of scientific inquiry, given his apparent commitment to the view that representations and objects of representations are constrained by the rules of our understanding; or are we constrained to conclude that questions of ontology are not cogent in a Kantian context? It is these questions to which we turn next.

CHAPTER 5
TRANSCENDENTAL IDEALISM: A UNION OF EMPIRICAL REALISM AND METAPHYSICAL ANTI-REALISM

The prior chapters argued for, *inter alia*, the following: (1) One of Kant's primary concerns in the *Critique of Pure Reason* was to justify certain knowledge claims including our knowledge of necessity in the sciences. (2) Kant takes cognitions to be mental representations that have objective purport, that is, that they have some relation to external objects, notwithstanding that these representations undergo some cognitive processing pursuant to *a priori* rules of the understanding. (3) If we want to discern laws for how external objects interact with each other, then we must treat them vis-à-vis their capacity for motion—in conjunction with the *a priori* rules of the understanding. (4) While Kant ultimately rejected the possibility that psychology could be a proper science, his criticisms of psychology do not extend to the analysis of mental representations of spatially extended external objects, that is, a subset of mental representations originating from "outer sense."

But given Kant's basic commitments as a transcendental idealist—including the idea that we know phenomena (that is, objects as we represent them), and we cannot know noumena (*i.e.*, objects as they are in themselves independently of how we represent them)—we might wonder about the ontological status of the objects of scientific knowledge; are they real and knowable, but only as phenomena? What is their relationship to noumena, if it can be known? And what of the ontological status of *unobservable* objects of scientific knowledge—that is, are we in an epistemically weaker position vis-à-vis unobservables, and, if so, is their ontology to any extent more dubious? As Allison noted, Kant's transcendental idealism has been the recipient of some goodwill in anti-realist corners because of his argument for the "dependence of our conception of reality on our concepts and/or linguistic practices . . ." (2004, 3). The connection between transcendental idealism and debates about scientific realism is thus patent.[111]

The present chapter notes the allure of considering Kant's transcendental idealism to be a form of scientific anti-realism insofar as the former posits unknowable *noumena* that our sensory and conceptual faculties are incapable of apprehending. However, this chapter will argue that, on closer inspection, Kant should be considered a scientific realist to the extent that he places observables

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[111] Allais (2003) has argued that viewing Kant's transcendental idealism through the lens of the realism/anti-realism debate may help "shed light on some of Kant's insights that have yet to be fully digested" (369). Indeed, Heidemann has gone so far as to argue that Kant's first *Critique* is the "founding document of *realism* [that] has shaped the theoretical landscape of the debates over realism" (2021, S3231).

While Allais develops comparisons between Kant and different strands of anti-realism, what she calls "Dummettian anti-realism, Putnam's anti-realism, and Wittgensteinian anti-realism," she maintains these types of philosophical anti-realism are distinct from anti-realism in "contemporary philosophy of science" (2003, 370). She describes Wittgensteinian anti-realism as the view that "there is no deep sense in which our concepts are answerable to reality, or no set of rules that is metaphysically privileged" (ibid., 372); and she associates several positions with Putnam, including, but not limited to, coherentism; the rejection of a "theory-independent reality[; and] rejection of the idea of a uniquely true theory of the world" (ibid., 375). Allais argues that neither Wittgensteinian nor Putnam's anti-realism are similar to Kant's transcendental idealism; however, she allows that Dummettian anti-realism, insofar as it rejects "verification-transcendence" (which is the notion that there exists some state of affairs for which "we can have no evidence, or no reason for thinking that it [is] the case")—is akin to Kant's transcendental idealism (ibid., 377, 382). This is consistent with the interpretation offered here vis-à-vis Kant's scientific realism.

and unobservables—*i.e.*, those entities that are the subject of the realism/anti-realism debate in the philosophy of science—on the same ontological footing, notwithstanding that we stand on somewhat different epistemic ground *vis-à-vis* these different types of entities. But insofar as we focus on the question of metaphysical realism/anti-realism, which, briefly stated, concerns whether we can acquire knowledge of the entities (observable or unobservable), as they are, independent of human cognition, Kant should be construed to be a metaphysical anti-realist.

To that end, this chapter is organized as follows: it will (1) give a general primer on scientific realism/anti-realism; (2) explain the metaphysical realism/anti-realism distinction and situate Kant along the axis of scientific and metaphysical realism/anti-realism; (3) show how we can understand Kant's claims of noumenal ignorance given his commitment to scientific realism; and (4) conclude with a recapitulation of the arguments in this project as a whole and situate them in broader context of Kant's thought.

1. A Primer on Realism/Anti-realism

Regarding the ontological status of scientific objects, we can begin with a coarse-grained distinction between realism and antirealism. Van Fraassen described realism as the view that "[t]he aim of science is to give us a *literally true story of what the world is like*; and the proper form of acceptance of a theory is to believe that it is true" (1984, 250) (emphasis in original). *See also* Levin 1984, 124 (giving an equivalent description and describing it as the "old-fashioned" formulation of the view). Van Fraassen observes that there are two components to this conception of realism: (1) that scientific language is to be literally construed; and (2) it is true.[112] Accordingly, anti-realists could contest realism by either arguing that (1) scientific language should not be construed literally; or, alternatively, (2) if it is literally construed, it need not be true (van Fraassen, 250-51). Levin describes antirealism as "the thesis that the nonobservational portions of even 'true' theories are not really assertions about the world, but devices of some sort for, say, codifying relations between observable variables" (1984, 124-25). As this illustrates, realists and antirealists typically bisect the world into observables and non-observables and thereafter take positions about whether scientific theories about non-observables are literally true or, we might say, functionally true (that is, they provide ways for describing and predicting observable events).[113]

Levin, though he defends realism, questions the utility of bundling truth claims in with realism. As he illustrates:

> Surely the reason airplanes stay up is not
>
> (1) "The pressure on the underside of a moving airfoil is greater than the pressure on its overside" is true,
>
> but rather

[112] Boyd identifies four "central theses" of realism: (1) that theoretical language referring to non-observables should be interpreted "realistically"; (2) so interpreted, scientific theories are confirmable by "ordinary scientific evidence" using "ordinary methodological standards"; (3) history demonstrates progressively more accurate approximations of truth about observables and unobservables; and (4) the "reality which scientific theories describe is largely independent of our thoughts or theoretical commitments" (1984, 41-42).

[113] Levin distinguishes between what we can call weak and strong anti-realism, *i.e.*, the idea that any given scientific theory, no matter how well-established, could be false (weak); or, that scientific theories do not have a truth value at all (strong) (1984, 125). Levin attributes the weaker position to, among others, van Fraassen (ibid., 125).

(2) The pressure on the underside of a moving airfoil *is* greater than the pressure on its overside (1984, 126).

Levin argues that a theory is successful if, using "its own internal resources," it makes predictions which come to pass—rather than "some such other hypothesis as truth" (ibid., 127). He distinguishes between the "real" and "calculative" parts of theories, where, taking the special theory of relativity as an exemplar, its real part would be the constant velocity of light in every frame of reference (observable), whereas the Minkowski geometry, with which one could use to mathematically describe such phenomena,[114] would constitute the calculative (unobservable) part of the theory (ibid., 129). Levin charges that the antirealist takes a legitimate distinction between observables and unobservables in one context—for example, the special theory of relativity—and "overextends" it to all theories (ibid., 130). Instead, he argues, we ought to take science at face value, and "proportion [our] assent to the precise degree of evidence that occurs" (ibid., 133, 134).

Between anti-realism and realism reside views such as Fine's "natural ontological attitude" ("NOA"), which consists of what he asserts is the "core position" common to both realists and anti-realists, namely, that "both realist and antirealist accept the results of scientific investigations as 'true', on par with

[114] While in Newtonian physics, space and time are separate, Einstein conceived of space and time as intertwined such that the space-time continuum includes the three dimensions of space and the fourth dimension of time: "In Einstein's concept of the physical universe, based on a system of geometry devised by Hermann Minkowski (1864–1909), space and time are regarded as entwined, so that two observers in relative motion could disagree regarding the simultaneity of distant events. In Minkowski's geometry, an event is identified by a **world point** in a four-dimensional continuum" (Rennie and Law 2019).

more homely truths," though one may add additional claims to the core view depending on where one stands on the realism/antirealism question. For example, the antirealist, Fine argues, merely "add[s] onto the core position a particular analysis of the concept of truth, as in the pragmatic and instrumentalist and conventionalist conceptions of truth" (1984, 96-97). In contrast to realism and antirealism, the NOA "recognizes in 'truth' a concept already in use and agrees to abide by the standard rules of usage," rather than attempting to marshal "nonexistent resources" to settle debates about what conception of truth should be employed (ibid., 101). NOA "grounds judgments of truth in perceptual judgments and various confirmation relations," and asserts there is nothing further to be done (ibid., 101).[115]

2. Realism, Antirealism, or Something in Between?

Okruhlik argued that whether Kant is a scientific realist or anti-realist depends on the theoretical entities in question. For example, Kant discusses "pure earth, pure eater, pure air, etc." in the Appendix to the Transcendental Dialectic, and though he acknowledges they are not found in nature, he asserts that we may use them as concepts to aid in constructing a taxonomy of chemical phenomena (1986, 311) (discussing B 674). In any event, Okruhlik further argues that because chemistry could not constitute a proper science for Kant (for the reasons discussed in *supra* chapter three), Kant could not be a scientific realist

[115] As Heidemann 2021 notes, there are other approaches to the contemporary realism debate that Kant did not anticipate, though their relevance to Kant's project is questionable (S3250 n.34 and accompanying text). Consistent with this observation, this chapter is limited to discussing general forms of realism/anti-realism vis-à-vis Kant.

about theoretical chemical entities (1986, 313). The logic seems to be that if some entities are not part of a scientific theory, then Kant could hardly be a scientific realist about those entities. Rather, Kant could only be a scientific realist about entities postulated by a proper scientific discipline. Should chemistry become mathematizable due, say, to the development of atomic physics, Kant could then be a scientific realist about its theoretical entities (ibid.). Taking for granted Okruhlik's insightful point that we should be cautious to remain in the domain of proper science when analyzing Kant's views on theoretical entities, we nevertheless may question whether Kant is a scientific realist about theoretical entities posited by proper sciences.

Recall the different conceptions of realism stated above. For van Fraassen, there are two components to realism, namely, that theoretical language should be construed literally, and so construed, it is true. Boyd identified four components to realism, *i.e.*, that theoretical language should be interpreted realistically, they are confirmable using ordinary scientific methods, science progresses over time, and scientific theories describe a reality "largely independent" of human cognition (1984, 42). As will be argued below, by van Fraassen's formulation, Kant is a scientific realist; though, by Boyd's, Kant does not fit the bill because, even though he embodies the first three criteria of realism, he rejects the fourth (that is, the requirement that theoretical entities are "largely independent" of human intellectual activity).

Okruhlik argues that Kant is a scientific realist about Newtonian physics, specifically the underlying fundamental forces of attraction and repulsion that Kant posits in the *Metaphysical Foundations* (1986, 317). She observes that evidence for Kant's realism may be found in his discussion of the *truth* of the knowledge of the understanding, which, he argues, may be evaluated based on the systematic unity of its rules (ibid., 319) (discussing B 675). Here we see the language of realism, namely, truth, reflected in Kant's treatment of knowledge. Kant's requirement that science provide causal explanations and novel predictions, along with his emphasis on the truth of scientific knowledge, demonstrates that he seeks more than empirical adequacy for theoretical entities (ibid., 320).

Okruhlik suggests the following criterion for Kant's scientific realism: "The dividing line between the real and unreal is not the line between the observable and unobservable, but the line between what the best theory postulates and what it does not" (1986, 321). That is, Kant's Copernican revolution requires that any assertions about the world need to be objects of possible, *but not actual*, experience, and they therefore need to conform to the pure intuitions of space and time as set forth in the Transcendental Aesthetic, and must be subject to the categories as elucidated in the Transcendental Deduction. Indeed, Kant stresses in the Postulates that perception of scientific entities is not strictly required, but rather, theoretical entities must have *some* connection with objects of perception:

> The postulate for cognizing the **actuality** of things requires . . . not immediate perception of the object itself[,] the existence of which is to be cognized, *but still its connection with some actual perception in accordance with analogies of experience*, which exhibit all real connection in an experience in general (B 272) (italics added).[116]

[116] *See also* Duncan 1986, 279.

Kant provides an example: "the existence of magnetic matter penetrating all bodies," which we can know of based on the "perception of attracted iron filings, *although an immediate perception of this matter is impossible for us given the construction of our organs*" (B 273) (emphasis added). To remove any doubt about Kant's position on theoretical entities, it is worth quoting verbatim his next remarks:

> For in accordance with the laws of sensibility and the context of our perceptions we could also happen upon the immediate empirical intuition of it[, *i.e.*, unobservables, in this case, magnetism,] in experience if our senses, the crudeness of which does not affect the form of possible experience in general, were finer (B 273).

In other words, our sensory limitations do not prescribe limitations on the existence of theoretical entities because of our inability to observe them, provided the postulated entities conform with *a priori* pure intuitions and rules of the understanding.[117] Thus, Kant is a scientific realist about the fundamental forces of attraction and repulsion (Okruhlik, 1986, 322), at least pursuant to van Fraassen's description of realism.[118]

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[117] *Accord* Duncan 1986, 278 (noting that "magnetic matter" is an object of possible experience, since we could perceive them if we had "sense organs of greater resolving power," such as "better eyes . . ., or failing that, a microscope of sufficient power").

[118] If theoretical entities are postulated—as objects of possible, rather than actual, experience—based on the criteria described above, we might wonder why we should take unobservables to be cognitions, that is, to have objective validity, rather than merely logical possibility. Duncan suggests, as a response to this issue, that the objective validity of unobservables derives from their causal explanatory relationship to observables (1986, 280). So, for example, an empirical observation such as the resistance of an object to the motion of another "is an observable datum that must be explainable by any adequate theory of matter" (ibid., 281). Repulsive force, as a fundamental force which accounts for matter's ability to fill space, performs explanatory work above and beyond explaining resistance by appeal to matter's mere "irreducible solidity or

If it is the case that Kant is a scientific realist about theoretical entities, how should we square his claim that proper science requires the ability of objects to be mathematically constructible *a priori*? For Okruhlik, theoretical entities are not mathematically constructible *a priori* because they are discovered *a posteriori*, but, she implies, they *are* mathematically constructible in the sense that we can give them a "formal mathematical treatment" (1986, 321). That is, we

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impenetrability" (ibid.). The fact that unobservables must be consistent with, and stand in a lawlike causal relationship with, observables shows that theoretical entities cannot be the result of mere rational speculation based on merely *a priori* principles.

As Duncan puts it, theoretical entities/forces may not be deduced from "the *a priori* principles of [Kant's] own system, the transcendental principles of the understanding[,] and the general concepts of the fundamental forces themselves," because they do not "possess sufficient empirical content to warrant the determination of the laws of repulsion and attraction" (1986, 283). So, for example, repulsive forces are postulated as causes of the effect of felt resistance and our accompanying perceptions of a spatially extended object's size and shape; and, of course, as a causal explanation, the relationship between repulsive force and felt resistance is asymmetrical: repulsive forces must explain felt resistance, but felt resistance is insufficient to determine fundamental forces (ibid., 283-84). While mathematical construction is discussed below, it should be noted that, concerning unobservables, mathematical construction confers greater credibility for taking a theoretical entity to truly exist, since it shows "the possibility of there being objects of possible experience of the sort specified by the hypothesis" (ibid., 289).

As an interesting aside, consistent with this discussion, Kant would be a realist about even contemporary theoretical entities such as strings. Physicist Brian Greene hypothesizes that strings are the "fundamental ingredient" of all fundamental particles, and that strings vibrate in different patterns, each of which produces a specific set of properties that, together, constitute different fundamental particles (2004, 346-47). While strings are unobservables, and may, due to technological limitations, forever be unobservable, they are not in principle unobservable, since they are spatially extended, that is, they are "roughly a Planck length (10^{-33} centimeters)" long (ibid., 349). String theory posits that strings are the smallest physical entity, and so space ceases to become divisible at the Planck length—though, "[a]s for what concepts take over, there is as yet no consensus" (ibid., 350).

hypothesize the existence of theoretical entities based on observable phenomena and then we give a mathematical representation of the theoretical entities, which satisfies Kant's requirement that proper science requires mathematization.

Duncan, however, claims that Kant denied that the fundamental forces could be mathematically constructed, which would seem to support the idea that fundamental forces are not "legitimate hypothes[e]s at all" (1986, 285).[119] Duncan takes a similar approach as Okruhlik, namely he proposes that fundamental forces are susceptible to mathematical construction, even if Kant was unable at the time to provide such a construction. The logic is as follows: the construction of a physical concept is to give an "intuitive representation" of it; the representation itself is a mathematical one "taken over into the domain of physical theory" (Duncan 1986, 289). He explains:

> As was the usual practice in Kant's day, the representation was borrowed from geometry. For example, one finds "atom" represented by constructions of geometrical points, motions and velocities, by constructions of lines of appropriate magnitude. The drawings must, as in geometry, be interpreted or idealized as representations of their concepts; the dot must be interpreted as a particle, as an atom. And the contents of the physical concept cannot be read off from the drawing: A drawing is a specific construction only under a specific interpretation (ibid., 289).

Thus, mathematical construction can be a "representation by analogy," the truth of which "depends upon there being in nature structures to which the structure of the mathematical model bears sufficient positive analogies" (ibid., 290).

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[119] If we take fundamental forces to be regulative, then they need not conform to the requirements of proper science, and we need not be concerned with their potential resistance to mathematical construction. *See* Duncan 1986, 287 (discussing Butts 1986 who argues for this reading of Kant). Duncan rightly rejects this reading because it would rob fundamental forces of their explanatory value (ibid.).

However, the possibility of developing an appropriate mathematical model is a practical concern—that is, mathematical construction requires the development of "appropriate geometrical figures" (ibid.). To the extent that Kant expressed skepticism about providing adequate mathematical models for fundamental forces (specifically repulsive forces, *see* 4: 520-521), we need not interpret him as arguing in principle against the possibility of mathematical construction, but, rather, we may interpret him as commenting on the limits of what was possible based on the mathematical models available at the time (Duncan, 1986, 293). As Kant stated, it is not the task of metaphysics to mathematically construct concepts of matter (4: 517-518).

Let us return, however, to the fourth criterion for realism, as formulated by Boyd, that is, that scientific theories posit a reality independent of human cognition. Okruhlik uses the scientific/metaphysical realism distinction to characterize the difference between Kant and Boyd; she maintains that Kant is a scientific realist, but not a metaphysical realist (because of his transcendental idealism), whereas Boyd is not only a scientific realist, but also a metaphysical realist because he takes the truth to be independent of human cognition (1986, 323). Conversely, van Fraassen is a scientific anti-realist, but also a metaphysical realist; that is, Okruhlik, describes van Fraassen as holding that there are propositions with truth values independent of human cognition, but also that the theoretical entities postulated by scientific theories should not be taken to be true (ibid., 325).

In other words, we might make a distinction between scientific realism/anti-realism and metaphysical realism/anti-realism. If we can tease the scientific and metaphysical claims apart, we find that there are four combinations:

1) Scientific realism & metaphysical realism.
2) Scientific realism & metaphysical anti-realism.
3) Scientific anti-realism & metaphysical realism
4) Scientific anti-realism & metaphysical anti-realism.

Based on this quadripartite distinction, we see that the scientific realism/anti-realism debate is often framed in terms of numbers one and three; that is, baked into the debate is a specific position about the existence of truths independent of human cognition, that is, there are such truths (metaphysical realism), and either science uncovers such truths (scientific realism) or it does not (scientific anti-realism). What the foregoing shows is that Kant is a scientific realist in the sense that he confers on unobservables the same ontological and epistemic status as observables, provided the observables are related to actual scientific observations, they conform to the *a priori* forms of intuition (space/time) as well as the categories, and they are mathematizable.[120] However, his transcendental idealism means that his scientific realism must accommodate metaphysical anti-realism (that is, any and all scientific knowledge, regarding observables and unobservables alike, must always be with respect to human cognition).

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[120] Duncan suggests that there are two "rules for theorizing" about unobservables: (1) connection with observables; and (2) conformity with empirical causal laws (1986, 279). That is, the postulated unobservables must explain the behavior of observables, consistent with the principles of the understanding and the "empirical causal laws that instantiate them" (ibid.). But, *contra* Newton, for Kant, unobservables need not have all the same qualities we ascribe to observables (ibid., 274, 279).

In which case, we have a principled conceptual distinction that tracks the difference between phenomena (including observables and unobservables), which are things about which we can be scientific realists, and noumena, which are things that do not fall into the traditional observable/unobservable distinction, and which one cannot assert knowledge of because they are independent of the possibility of human cognition, which compels that we be metaphysical anti-realists about them. But what does this distinction between scientific realism and metaphysical anti-realism look like concretely? This is an important question because if we cannot illustrate how this distinction manifests, transcendental idealism could be perceived as a trivial philosophical position, perhaps of merely terminological import. Thus, we must turn directly to the issue of Kant's transcendental idealism.

3. How to Square Kant's Scientific Realism with his Transcendental Idealism

Okruhlik notes, rightly, that—even if we take Kant to be a scientific realist about theoretical entities—because of his transcendental idealist commitments, we cannot mistake his scientific realism for what we could call "metaphysical realism"; that is, we must ensure not to conclude that the theoretical entities about which Kant is a scientific realist constitute noumena (1986, 318). As Duncan notes, the theoretical entities Kant is a scientific realist about are phenomena because they are objects of possible, if not actual, experience, unlike noumena (1986, 278).

Now, recall the distinction suggested in *supra* chapter four, regarding outer sense—that is that it relates to both the objects of outer sense and representations of those objects. As argued in chapter two, when we take our *representations* to have objective purport, that is, to be cognitions, we take them to stand in a certain relationship to the *objects* of representation. At the very least, this relationship must be causal. This is a foundational premise undergirding Kant's project in the *Metaphysical Foundations* because he starts from the observation that external objects causally affect our senses through motion; thus, motion becomes the lens through which we attempt to understand the interaction between objects, which gives rise to the fundamental forces of attraction and repulsion, and so on. So—if we approach the phenomena/noumena issue from a different standpoint, *i.e.*, by distinguishing between *representations* of outer sense and the *objects* of our representations of outer sense (rather than distinguishing between observables and unobservables), the question arises: what, if anything, may we say about the noumenal dimension of objects of our representations of outer sense?

Rosefeldt argues that the objects of our representations of outer sense (hereinafter "objects of outer sense," for shorthand) could be interpreted to mean, for Kant, either merely phenomenal objects that causally interact in space-time; or "he could mean the objects that are the noumenal grounds of these empirical objects and of our experience of them" (2022, 17). This leads to two alternative explanations for how objects of outer sense relate to our representations of outer sense ("representations," for shorthand): they are either (1) the "empirical explanation of the content of experience"; or (2) the "noumenal explanation of the content of experience" (ibid.).

According to the former, it is the properties objects of outer sense have, *as phenomena*, that partially cause our representations. According to the latter, it is the properties objects of outer sense have, *qua noumena*, that partially cause our representations. In other words, the question is no longer whether unobservables are the noumenal grounds of observables (phenomena), but rather, whether the objects of outer sense (including their observable and unobservable characteristics) have noumenal qualities that stand in some relation to our phenomenal representations.

At this point it is appropriate to note that there are several ways of cashing out the concept of *noumena*. In a metaphysical sense, we might take the phenomena/noumena distinction to signal the difference between two types of properties or two types of objects (Bader 2022, 279). These views have also been referred to as the "two-aspects" and "two-objects"/"two-worlds" views, respectively. *See* Allison 2004, 3. Though there is what Allison has described as a "lively dispute" about which of the two views is a more accurate interpretation of Kant, the two-world view continues to have many adherents, who then often "summar[ily] dismiss[] . . . transcendental idealism as a viable philosophical position" (Allison 2004, 3).[121] As Allais has observed, with respect to the two-aspects versus two-worlds interpretation, "not only is there no convergence in the

[121] *See* Allison 2004, 4-11 (describing representative samples of philosophers attributing to Kant the two-world view and then refuting that view); and *see*, *e.g.*, Guyer 2004, 67-70 for an argument for the two-worlds interpretation.

literature as to which of these is correct, there is not even consensus within these groupings" (2003, 369 n.2).[122]

The two-aspects version of transcendental idealism is discussed further below. For the time being, let's stick to the two-worlds interpretation, according to one version of which, phenomena and noumena are ontologically distinct objects, *but*, noumenal objects ground the existence of phenomenal objects (Bader 2022, 279). Bader provides an account of how the two-world view could plausibly function. He suggests that there is a correspondence between the phenomenal and noumenal realms in the form of a "coordination relation," which is just the "translation function of the process of intuition," that is, "[t]his function translates the matter provided by noumena into phenomenal properties,

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[122] *See also* Allais 2004, 657 (observing that the two-worlds view has been "dominant historically," but the two-aspects view had been catching up in the second half of the twentieth century).

Additionally, we should note that the relevant distinctions may be epistemological or ontological—thus, for example, the two-aspects view may hold that the distinction between phenomenon and noumenon is merely a consequence of two different perspectives on the same thing; or, alternatively, it can reflect the idea that there are two sets of properties the same object has, some of which we can apprehend (phenomena) and some of which we cannot (noumena). *See* Allais 2004, 658. Heidemann likewise distinguishes between the "epistemic (methodological)" and "ontological (metaphysical)" versions of the two-aspects view. According to the epistemic view, the same empirical object could be a phenomenon and also noumenon in the sense that the empirical object's existence in space and time is real, while no existence claims are made with respect to its noumenal reality (2021, S3238). According to the ontological (metaphysical) version of the two-aspects view, empirical objects exist and are grounded in really existing things-in-themselves, though we can have no knowledge of *noumena* otherwise (ibid.). The foregoing shows that the two-aspects/two-worlds views may focus primarily on an epistemological or ontological distinction—but the epistemological and ontological issues are nevertheless interrelated. The view advocated for herein is the ontological (metaphysical) two-aspect view, which has epistemological implications.

into a spatiotemporally ordered manifold, thereby giving rise to the phenomenal 'images' of the noumenal entities" (2022, 284). The two-worlds view preserves noumenal ignorance—the fact that we cannot say anything in particular about noumena—Bader argues, because "we lack knowledge of the way that the translation function works and are not able to reverse-engineer the process whereby phenomena arise" (ibid., 289). That is, we cannot get from phenomenal output to noumenal input (ibid.). A main draw of such a reading is that it, *inter alia*, "takes seriously the idea that transcendental idealism is a form of idealism . . . ." (ibid., 279).

A consequence of this two-worlds view seems to be that the phenomenal world is actually a mental one, albeit grounded in an external noumenal one with unspecified properties. However, as shown in chapters two, three, and four—and implicit in the above discussion of Kant's scientific realism—a foundational premise of Kant's *Metaphysical Foundations* was that motion was the primary lens through which we should philosophize *a priori* about matter because objects of outer sense affect our senses through motion, and, accordingly, "[t]he 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*" (4: 476-477). Stated otherwise, we have representations of outer sense (that is, representations of external objects) that stand in causal relation to external objects; and those objects have the property of motion, through which they affect our senses and thereby give rise, in part, to our representations of objects. So Kant seems to really attribute to external objects properties, such as motion, which is inconsistent with the two-worlds view, if by two-worlds, we mean that the external noumenal world is full of objects with unknowable properties and relations.[123] Rather, the alternative that is much more consistent with Kant's philosophy of mind and philosophy of science—and just as consistent with Kant's transcendental idealism, including his requirement of noumenal ignorance—is the two-aspects view, an exemplar of which we find in Rosefeldt 2022.

Rosefeldt points out that at A 107, Kant states that a cognition of an object corresponds to an object distinct from that cognition and, "insofar as they are to relate to an object[,] our cognitions must also necessarily agree with each other in relation to it" (Rosefeldt 2022, 21). This suggests that Kant required different cognitions of the same object to correspond to that object and cohere with each other (ibid., 22). Later, Rosefeldt notes, Kant argues that "[i]t follows naturally from the concept of appearance in general that something must correspond to it which is not in itself appearance," such that the former (*i.e.*, the appearance) is our sensible representation of an object, and the latter is "an object independent of sensibility" (ibid., 23) (quoting A 251-252). In other words, Rosefeldt argues

[123] *Accord* Heidemann 2023, 21-22, 30, 32 (arguing that Kant is a mental content externalist in the sense that our "mental representations depend on extra-mental content," namely, the affections of our sensory organs by external objects, which are "real external causes of our perceptual beliefs about the world," and which provide the content our minds organize into mental representations). That said, Heidemann differs in some ways from the views adopted herein. For example, he seems to deny that Kant makes existential claims about noumena, *see* 2021, 3240, whereas below, it is argued that Kant makes minimal claims about the existence of noumena because, as he says, to do otherwise would be absurd. To assert the existence of noumena, Heidemann charges, puts one in danger of falling into transcendental realism, *i.e.*, the view that objects of our senses exist in space and time independently of human sensibility, which is a view Kant criticizes (ibid., 3241). As discussed further below, noumenal ignorance requires rejection of transcendental realism, and the interpretation developed here preserves noumenal ignorance.

that objects of perception cause our representations, which explains their coherence with other representations (ibid., 24).[124]

Consistent with the two-aspects view, Wilson observes that Kant distinguishes the sensation of, for example, colors, which are "modifications of the sense of sight," from their causal origin, that is, the affection of sight "in a certain manner by light" (1999, 300). Recall from the discussion of intensive magnitudes in the Anticipations of Perception that there is a causal relationship between objects and sensations, and that there is a correlation between the degree of sensation (which is not a property attributable to an object) and the degree of reality in the cause (B 208, B 210). This illustrates there is a distinction between representations and their objects, and the two stand in a causal relationship; and though they have a causal and correspondence relationship, representations do not necessarily resemble the properties of the objects that cause those representations. *Accord* Wilson 1999, 300. As Kant later explains in the fourth Paralogism in the A edition: "Every outer perception . . . immediately proves something real in space, or rather is itself the real; to that extent, empirical realism is beyond doubt, i.e., *to our outer intuitions there corresponds something real in space*" (A 375) (emphasis added). Thus, that which scientific theories postulate exists in space, and "the fundamental concepts of scientific understanding of . . . matter are . . . implicit in the ordinary experiential ordering

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[124] While coherence and correspondence are often placed in opposition to one another, there is no contradiction in viewing Kant as positing the coherence of our representations based on their causal relationship to objects which in some sense correspond to the representations. *See*, *e.g.*, Heidemann 2023, S3246 n.23 (arguing that Kant is a coherentist, though "correspondence is pivotal for Kant").

of the world," because the scientific image of the world informs us of the objective properties the world has that stand in causal relation to our representations (Wilson 1999, 301-302). This again shows that Kant is an empirical realist; but now we must attempt to draw the line between the realist external world Kant posits and the noumenal world about which we cannot speculate.

There is evidence in the preface to the B edition of the first *Critique* for the two-aspects interpretation of Kant's transcendental idealism: "[E]ven if I cannot **cognize** these same objects [of experience] as things in themselves, we at least must be able to **think** them as things in themselves. *For otherwise there would follow the absurd proposition that there is an appearance without anything that appears*" (B xxvi – xxvii) (italics added). To emphasize: in Kant's words, while we cannot cognize objects of experience as they are in themselves, it is an absurdity to suggest that objects of experience *do not* have a way they are in themselves, even if we are incapable of apprehending it.

The following passage from the first *Critique* is further textual support for the two-aspect view:

> Nevertheless, it lies already in our concept, material nature (phenomena), if we call certain objects such, as appearances, the kind that we see that we distinguish from their constitution in themselves, since we do not see them in their ultimate constitution, or other possible things that are not objects of our senses, but merely thought in our intellect, that, so to speak, are placed in opposition, and they are called intellectual nature (noumena). Now there is the question: whether our pure concepts of the understanding have this ultimate meaning in view, and could be a kind of knowledge [cognition] of it? (B 306) (my translation).

This seems to show that the same objects of our sensory experience have a constitution, a nature, as they are "in themselves" independent of how we perceive them. There is no second set of objects denoted as being noumenal; rather, noumena just are experiential objects as they are constituted in themselves apart from how we see them.

Rosefeldt ultimately cashes this out by supposing that an object of representation has what he calls “response-dependent properties” and “response-independent properties,” where a response-dependent property is a phenomenal spatio-temporal property an object has that constitutes a “disposition of the object to elicit,” or cause, a certain effect (in this case a certain representation) (2022, 27-28). A response-dependent property is a higher, second-order, property grounded on a first-order property, namely, a response-independent property, which is a noumenal property (ibid., 28).[125] However, to preserve Kant’s central claim that we cannot know anything about noumena:

> . . . [K]nowing that things have a certain response-dependent property does not imply any knowledge about *which* response-independent property it is that elicits the response and not even knowledge that it is always the same response-independent property that plays this role (ibid.).

In other words, we can know that representations are caused by, and correlated with, objects’ response-dependent (phenomenal) properties; and, further, the response-dependent properties are grounded in response-independent (noumenal) properties. However, the nature of the grounding relationship between response-dependent and -independent properties is unspecified, which—along with the fact that there is nothing specific at all that we can say

[125] Following Bader, we can also refer to this two-aspects view (according to which noumenal properties ground phenomenal properties) single-domain supervenience (2022, 281).

about response-independent properties— allows us to preserve Kant's assertions of noumenal ignorance (ibid., 40).[126]

It is crucial to keep in mind Kant's requirement for noumenal ignorance even if we assert the existence of empirically real external objects in space which stand in causal relation to our representations. In the fourth Paralogism in the A edition, as discussed above, Kant affirmed the existence of real objects in space that stand in causal relation to our representations, nevertheless, he also reiterated that space can never be proven "in the strict sense" because space is the form of our intuitions:

> Thus, the strictest idealist cannot demand that one prove that the object outside us (in the strict sense) corresponds to our perception. For if there were such a thing, then it still could not be represented and intuited outside us, because this would presuppose space; and reality in space, as a mere representation, is nothing other than perception itself (A 375-376).

In sum, here Kant recommits himself to scientific realism but metaphysical anti-realism. We have representations which stand in causal relation to objects of outer intuition, but to go any further than that which we take to be "connected with a perception according to empirical laws" (A 376) is nonsensical because we have no way of knowing or proving whether these objects, as they are in themselves, independent of possible experience, are really spatially extended and correspond to our representations (A 376-377). If we were to try to attribute

[126] The foregoing reconstruction of a two-aspects view seems consistent, in broad strokes, with Allison's argument that an "epistemologically based understanding of transcendental idealism requires that the transcendental distinction between appearances and things in themselves be understood as holding between two ways of *considering* things . . . rather than as . . . between two ontologically distinct sets of entities" (2004, 16).

spatiality to noumena, we would be in a vicious circle of attempting to prove that the object has spatiality as a noumenal property, when spatiality is really only the form of outer intuition (A 376-377).[127] Both empirical realism and metaphysical anti-realism are thus crucial to Kant's transcendental idealism.[128] As Heidemann argues, in similar fashion, Kant's transcendental idealism and empirical realism

[127] If string theory, discussed above, is true, then the concepts of space and time lose their applicability "on scales finer than the Planck scale" (Greene 2004, 350). It is uncertain exactly what the nature of reality is on scales smaller than strings. Some suggest that anything smaller than strings exists "outside the bounds of physical reality," and there are no spaces longer than a Planck length or shorter than a Planck time (a Planck time is how long it takes light to travel a Planck length) (ibid., 351). Others believe that "space and time do not abruptly cease to have meaning on extremely small scales, but instead gradually morph into other, more fundamental concepts," for which the ideas of space and time become meaningless" (ibid.). Either way, the parallel to Kant's things-in-themselves is striking—namely, that our scientific theories—which are constructed according to our cognitive framework, the most general of which are the *a priori* intuitions of space and time—suggest that space and time simply cease to apply beyond a certain point, which is reminiscent of Kant's claim that we cannot attribute spatial and temporal qualities to things in themselves. Should scientists ultimately be able to construct non-spatial concepts for theoretical objects, it seems safe to say Kant would be a scientific anti-realist about these objects since the fail the basic threshold test of being objects of possible experience.

[128] Heidemann suggests there are three criteria, the answers to which determine whether a view constitutes a type of realism or anti-realism: ontological independence, epistemic dependence, and veridical coherence (2021, S3247-48). Ontological independence holds that the world exists externally to, and independently of, mind; epistemic dependence is the view that existential *claims* cannot go beyond what we are capable of knowing; and veridical coherence provides that truths about the world "can only be established within the cognitive theory that underlies them" (ibid., 3244-45). Heidemann identifies Kant as a proponent of a form of realism that entails ontological independence, epistemic dependence, and veridical coherence (ibid., S3248). Heidemann's classifications are consistent with the interpretation developed herein, though I am endorsing a two-aspects interpretation which Heidemann does not seem to endorse.

"form a unity, i.e., only in combination [can] they demonstrate that objects of external perception are real" (2021, S3232), and thereby rebut skepticism.[129]

4. Conclusion

This project as a whole has taken the following arc: it began by emphasizing an epistemological reading of Kant, pursuant to which it drew out one of Kant's primary aims in his critical project, that is, to justify scientific knowledge. Next, we explored the cognitive nature of human experience, and saw that Kant hypothesizes that our concepts and intuitions combine to give rise to experience, and we employ the same fundamental rules of thinking, *i.e.*, the categories, to scientific objects; and, thus, we apply the same fundamental rational rules to our judgments, representations, and even the objects of our

[129] It should be noted that Heidemann identifies four difficulties with the ontological (metaphysical) two-aspect view, which is essentially what is argued for herein: (1) If noumena ground phenomena, how can we say anything specifically about this grounding relationship? (2) How can this view preserve noumenal ignorance when it claims to know some things about noumena? (3) What exactly are the "things" that appear one way but have unknowable aspects? And (4) Would this view not entail that noumena are also in space and time? *See* Heidemann 2021, S3240.

Each of these related issues can be dispatched quickly: (1) Noumenal ignorance provides that we cannot say anything specifically about the grounding relationship between noumena and phenomena—this is so to speak a feature rather than a bug in this position. (2) Noumenal ignorance is preserved in this view because we do not cognize the grounding relationship, though we can think of it, and, indeed, it would be absurd not to posit some non-cognizable relationship between phenomena and noumena. *See B xxvi – xxvii*. (3) Our inability to know the noumenal properties of things that manifest phenomenally is again a feature of the two-aspect view rather than a drawback—it just is the noumenal ignorance that transcendental idealism requires. Lastly, regarding (4), noumena may or may not be in space/time—simply because space and time are the forms of our intuitions—and therefore, we have no justification for applying them to noumena—does not give us justification for affirmatively ruling out their applicability to noumena.

representations. But, if objects of representation are somehow constituted, at least in part, pursuant to the categories, then the question arises whether it is possible for a transcendental idealist to have objective knowledge of the world. To answer this question, we need to distinguish between scientific and metaphysical realism to show that one can be a scientific realism about objects of possible experience, though metaphysical realism, *viz.*, knowledge of things as they are in themselves independent of any possible human experience, is foreclosed.

While this may be unpalatable for those seeking a "God's eye" view on the world, we must remember, it is hardly a shortcoming for Kant, who noted the impossibility of proving the existence of "God, freedom and immortality," and, accordingly, concluded he "had to deny knowledge in order to make room for faith" (B xxix – xxx). The fact that one can be a scientific realist and still have room for faith in the existence of supersensible things such as freedom, God, and immortality of the soul is what makes it possible for Kant to have, as he put it in the second *Critique*, an "ever new and increasing admiration and reverence" for the starry heavens above—which evince one's connection with "worlds upon worlds and systems of systems"— and the moral law within, which "presents [us] in a world which has true infinity . . ." (5: 162).

CHAPTER 6

CONCLUSION

Ultimately, this dissertation focused on Kant's philosophy of science, *i.e.*, how we might understand it in light of his transcendental idealism, and whether it has not just historical relevance, but also continuing relevance to contemporary developments in the sciences. The historical inquiry is delicate because we want to have fidelity to Kant's work and refrain from attributing to him ahistorical positions. The contemporary inquiry presents its own challenges because scientific methodologies and postulations have advanced since Kant's time; so, for example, what Kant understood to be psychology during his day does not necessarily capture the totality of that discipline today. Accordingly, it is very possible that Kant—notwithstanding his protestations about what constitutes science—may continue to have relevant things to say about contemporary scientific disciplines, even if he rejected the possibility that these disciplines, as he then understood them, could constitute proper science. In any event, a fundamental question arises in both the historical and contemporary context (even if the terminology we use to talk about these questions is distinctly modern): what implications does Kant's transcendental idealism have for our claims to knowledge of necessity about scientific truths?

With these issues in mind, this dissertation took the following form. Chapter one sought to demonstrate that one of Kant's primary aims in the first *Critique* was to respond to regional skepticism, that is, skepticism about the possibility of our acquiring knowledge of necessary truths in the specific regions of metaphysics and science. Chapter two argued that Kant advocated in the first

Critique for “intellectualism,” that is, the idea that the categories provide the form, or structure, for our mind’s synthesis of our representations, and it is these same categories which ground necessity claims about the world as it appears us. Chapter three presented an interpretation of Kant’s *Metaphysical Foundations of Natural Science* to serve as a model for a Kantian approach to other sciences by showing that, for Kant, proper science has an empirical component, but it is grounded on the *a priori* metaphysical laws which derive from human understanding (*i.e.*, the categories, the principles of understanding, and so on). Chapter four, based on the model given in chapter three, argued that Kant’s approach to science need not be limited to physics, but could also be extended in principle to other sciences as contemporarily practiced, in this case, psychology. This task was complicated by Kant’s explicit rejection of psychology as a science—but having put Kant’s criticisms of psychology in historical and textual context, chapter four argued that Kant’s criteria for science could indeed apply to some aspects, at least, of contemporary psychology. Lastly, chapter five addressed the question described above as fundamental, namely, the implications Kant’s transcendental idealism has for science, and argued that Kant’s transcendental idealism is central to his philosophical system, and that the best way to reconcile his manifest empirical realism his transcendental idealism is to recognize that despite his empirical realism, he is best understood as also being committed to metaphysical anti-realism. Chapter five additionally maintained that for Kant’s empirical realism and metaphysical anti-realism to be consistent with his scientific commitments—viz., the foundational premise in the *Metaphysical Foundations* that motion is a fundamental empirical concept because it is *via* motion that matter affects our senses thereby giving the content for our mental representations—we should adopt a two-aspects, rather than two-worlds, interpretation of transcendental idealism.

One benefit to a project such as this is that it attempts to take Kant's philosophical positions seriously, while also keeping Kantian scholarship open to new horizons of exploration. Kant wrote widely on, *inter alia*, (transcendental) psychology, physics, ethics, and aesthetics, and it is possible to take Kant on his own terms, so to speak, while also showing not just how he diverges from, but also how he anticipated and may even contribute to, contemporary developments in these, and related, domains.

There are thus many remaining avenues for further research. This includes historical questions such as: to what extent did Kant later in life reconsider and reject some of his earlier positions (that is, how should the *Opus* impact our understanding of Kant's Critical-era writings? What was Kant's perceived "gap" in his Critical work, is it something we need to resolve, and if so, how?). Further related research that has a nexus with contemporary science includes: whether the development of non-Euclidean geometries and contemporary hypotheses about the nature of the physical world have falsified some elements of Kant's metaphysics; whether psychology can be mathematized in a way that satisfies Kant's requirements for proper science; and whether other contemporary sciences, such as chemistry, are capable of being approached in a Kantian way, notwithstanding his rejection of the discipline as it was practiced in his time; and how can we approach various contemporary scientific bodies of knowledge in a way that facilitates our understanding of them as being in principle unified, which in a way is simply the perennial project of reconciling what Sellars called the manifest and scientific images. Kant's transcendental idealism is very much alive, and it has plenty to offer.

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