KANT'S ILLUMINATING EXPERIMENT: ON THE PLACEMENT, PURPOSE AND ESSENTIAL PROCEDURE OF THE EXPERIMENT OF PURE REASON IN THE *CRITIQUE OF PURE REASON*

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Abstract. In his Preface to the second edition of the *Critique of Pure Reason*, and many of his lectures on logic, Kant discusses and lauds the efforts of Francis Bacon to establish physics as a natural science. In this essay, I explore the methodological influence of Bacon on Kant's own efforts to establish a scientific metaphysics in the *Critique of Pure Reason*. I argue that the experiment of pure reason that occurs in the Antinomy of Pure Reason can be considered a Baconian 'illuminating experiment', since: 1) as Bacon allows, illuminating experiments that intervene upon nature should be performed at a theoretical crossroads in order to make observable to the experimenter the facts necessary to determine which of available, plausible alternatives is correct; 2) given at least two important features of the *Critique of Pure Reason*, the Antinomy of Pure Reason is a theoretical crossroads about the fundamental principle that will allow metaphysics to become a science; and 3) the experiment of pure reason requires the philosopher to intervene upon pure reason's natural ratiocination in order to observe the facts necessary to decisively determine the correctness of the doctrine of transcendental idealism over against the doctrine of transcendental realism.

Keywords: Immanuel Kant, Experiment of Pure Reason, Philosophical Method, Transcendental Method, Francis Bacon, Illuminating Experiments, Experiment der Reinen Vernunft, experimenta lucifera.

Introduction

The Great Instauration is the name Francis Bacon gave to his monumental effort to reform natural philosophy into a practical science. According to its plan, the project was to consist of six parts. The first of these was intended by Bacon to provide an overview and classification of the sciences of his day. The second part was intended to detail the proper method of scientific investigation. Complementing the second, the third part was intended to provide the material for practical knowledge in the form of histories, natural and experimental. Bacon also intended to supply, in the fourth part of the Great Instauration, examples for guidance in the application of the

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new method. The fifth part was intended to present an inventory of provisional truths discovered not through the new method, but with the ordinary method of inquiry and discovery. The sixth part of the project, what Bacon called Second Philosophy, or Practical Science, was intended to present and expound the truths discovered by the new method of science thus supplanting the fifth part and, indeed, all ill-begotten "truth".

Although Bacon had been working on it since at least 1592, the material he had produced at the time of his death in 1626 was not enough to complete the project, nor any single part thereof. The first three parts are most nearly complete: only fragments exist of parts four and five, and part six seems never to have even been begun by Bacon. Of the first three, the second part is the most important, not just philosophically, but also historically.

The material for the second part of the Great Instauration was provided by Bacon in 1620 under the title, *New Organon, or True Directions Concerning the Interpretation of Nature*. The work consists of two books of aphorisms, although it is clear that he intended more: of the nine major topics introduced in the second half, only the first of seven that are relevant to this part of the project is treated in the remainder of the volume.[1] Book I offers an unembellished examination of what he famously calls idols or false notions (*idola*), which "not only block [people's] minds so that it is difficult for truth to gain access, but even when access has been granted and allowed…offer resistance and do mischief."[2] In Book II, Bacon presents the method of what he calls "true induction."[3]

Bacon's discussion of this method in Book II of the *New Organon* includes a distinction between illuminating experiments (*experimenta lucifera*) and fruit-bearing or profitable experiments (*experimenta fructifera*). Illuminating experiments precede fruit-bearing experiments and shed light on or illuminate the truth about or nature of something. Fruit-bearing experiments make use of such discoveries to achieve some effect or to make a product.

What follows is part of a larger study of the influence of Bacon's natural philosophy on Kant's *Critique of Pure Reason*.[4] That there is some influence is beyond doubt: Kant not only indicates a debt of gratitude to Bacon in many of his lectures on logic, he also selected an excerpt from Bacon's preface to the Great Instauration as the motto for the second edition of the *Critique*.[5] In this essay, I argue that Kant may have been methodologically influenced by Bacon's natural philosophy, as the experiment of pure reason that Kant introduces for the first time in his Preface to the second edition of the *Critique* can be considered an illuminating experiment, the purpose of which is to provide a crucial instance that decisively determines which of two mutually exclusive hypotheses is correct.[6] To this end, I show, first, that Bacon's discussion of illuminating experiments in the *New Organon* may be taken to imply, among other things, that they are undertaken at a theoretical crossroads so that the facts necessary to determine which of available, plausible alternatives is correct can be observed by the experimenter. Second, given the structure of the *Critique*, the Antinomy of Pure Reason in which the experiment of pure reason occurs, is a theoretical crossroads about the fundamental principle that will allow metaphysics to become a science. Third, the experiment of pure reason requires the philosopher to

intervene upon pure reason's natural ratiocination in order to observe the facts necessary to decisively determine the correctness of the doctrine of transcendental idealism over against the doctrine of transcendental realism.

Crucial Instances and Illuminating Experiments

The interpretation or understanding of nature requires the discovery of the forms of nature. As defined in the *New Organon*, forms are laws that "organize and constitute a simple nature:" indeed, "the form of heat therefore or the form of light is the same thing as the law of heat or the law of light."[7] Forms are discovered through application of the first part of the method of true induction; the second part of the method deploys fruit-bearing experiments based on the general laws or forms that have been discovered.[8]

The discovery of forms requires, first, a table of existence and presence. This table lists "all known instances which meet in the same nature, however disparate the materials may be."[9] As Bacon's investigation of the form of heat in the *New Organon* evidences, this table lists any phenomenon accompanied by heat: the rays of the sun, boiling liquids, quicklime sprinkled with water, compost, spices, and intense cold, to name a few.

Second, the discovery of forms requires a table of divergences, namely a table listing any phenomena closely related to those listed on the first table, but which is not accompanied by the form under investigation. As Stephen Gaukroger correctly points out, this has to be Bacon's strategy, because populating a list of any phenomena which is not accompanied by the form under investigation would be an impossible task: the list would be infinite.[10] Having begun his first table with the rays of the summer or noontime sun, Bacon begins his second table with the rays of the moon, lesser stars, and comets.[11]

A third table, namely a table of degrees or comparison, is also requisite. This table specifically presents the degree to which the form under investigation accompanies the same phenomena at different times or different phenomena at the same time. Bacon's Table of Degrees or Comparison on Heat notes, for example, "the sun has more warming power the nearer it approaches the perpendicular, or Zenith."[12]

Since "true *induction* is founded on *exclusion*," it is necessary to review the data of the three tables with a view toward eliminating any simple nature that is not both necessary and sufficient to constitute the form under investigation.[13] In particular, rejected are simple natures that are: absent from any phenomena accompanied by the form under investigation; present in any phenomena not accompanied by the form under investigation; present in any phenomena accompanied by the form under investigation, but which undergo a change without a corresponding change in the form under investigation.[14] At this point, the method of true induction produces what Bacon variously calls "an authorisation of the intellect, or a first approach to an interpretation, or a first harvest."[15] On the basis of his first harvest, Bacon provides the form or law of (the constitution of) heat: "if in any natural body you can arouse a motion to dilate or expand; and if you can check that motion and turn it back in on

itself so that the dilation does not proceed equally but partly succeeds and is partly checked, you will certainly generate heat."[16]

As its name suggests, the first harvest based on the tables of presentation, as well as on rejection, is not sufficient for the interpretation of nature. It is necessary to refine and otherwise perfect the form provided therein. For this, Bacon claims certain aids to the intellect are necessary. He proposes to discuss each in turn, beginning first with "*privileged instances*," and then to proceed to the nature of:

> …*supports for induction*; third of *the refinement of induction*; fourth of the adaptation of the *investigation to the nature of the subject*; fifth of *natures which are privileged* so far as investigation is concerned, or of which inquiries we should make first and which ones later; sixth of the *limits of investigation*, or of a summary of all natures universally; seventh of *deduction to practice*, or of how it relates to man; eighth of *preparations for investigation*; and finally of the *ascending and descending scale of axioms*.[17]

Despite his ambition, Bacon discusses only the first aid to the intellect, namely privileged instances, in the *New Organon*. There are twenty-seven privileged instances. At II.XXXVI, he discusses the fourteenth, namely crucial instances or instances of the fingerpost (*instantiae crucis*). Given the details of this discussion, it is possible to understand crucial instances in at least two ways.[18]

On one interpretation, crucial instances are *observations* of facts that must be obtained in order to decide between equally plausible alternatives. Accordingly, illuminating experiments provide these crucial instances, since it is through them that the experimenter can observe the decisive facts. According to another interpretation, crucial instances are *instruments*, i.e., the things that bring to the attention of the experimenter observable facts necessary to decide between equally plausible alternatives. Accordingly, crucial instances just are illuminating experiments. This latter is the conventional view, established, it seems, by Robert Boyle.

The term '*experimentum crucis*' or 'crucial experiment' seems to have first appeared in print in his *A Defence of the Doctrine Touching the Spring and Weight of the Air*, published in 1662. In this place, Boyle describes the experiment Blaise Pascal performed on the Puy-de-Dôme in 1648 as "an *Experimentum Crucis* (to speak with our *Illustrious Verulam*)" confirming that "the spring or motion of Restitution in the Air…tends outwards."[19] The interesting question is why Boyle attributes to Bacon the term 'crucial experiment', given that the term appears nowhere in Bacon's *corpus*?

As the editors of *The Works of Boyle* explain, Boyle identified crucial instances as experiments "devised to distinguish the true explanation from false ones."[20] This implies that Boyle took '*instantiae crucis*' to refer to the things that establish the facts necessary for a decision between alternatives. Some recent and contemporary commentators on the history and philosophy of natural science follow Boyle, interpreting '*instantiae crucis*' to refer to experiments.

Discussing the theory of light and colors Newton espoused in 1672, A.I. Sabra notes in passing that it was supported "with the aid of an *experimentum crucis* which in Newton's paper had exactly the same role as the *instantiae crucis* of the *Novum*

Organum: namely, it does not only refute the false doctrine but also positively establishes the true one."[21] Ian Hacking observes, "Bacon's fourteenth kind of instances are *Instantiae crucis*—a term later rendered as crucial experiment."[22] Defining "crucial experiment" as one that "manifestly favours the theory which had previously been the pauper," Geoffrey Cantor reports, "such experiments, or 'instances of the fingerposts' as Bacon called them, 'afford very great light, and are of high authority, the course of interpretation sometimes ending in them and being competed'."[23] Similarly, Barry Gower's view is that, of those identified by Bacon, "perhaps the most important kind of experiment is the one he called 'instance of the fingerpost', later called a 'crucial experiment'." [24] Still more recently, Rose-Mary Sargent claims that, "while later discussion of 'crucial experiments' was likely based upon this instance [of the fingerpost], Bacon used the term '*crucis*' in order to describe how these experiments could function much as the signs 'set up where roads part, to indicate the several directions'."[25]

It is important to notice that some of these commentators quote from the first paragraph of the aphorism. In this place, Bacon himself does seem to suggest that crucial instances are experiments. In detailing "how they work," Bacon writes:

> Sometimes in the search for a nature the intellect is poised in equilibrium and cannot decide to which of two or (occasionally) more natures it should attribute or assign the cause of the nature under investigation, because many natures habitually occur together; in these circumstances crucial instances reveal that the fellowship of one of the natures with the nature under investigation is constant and indissoluble, while that of the other is fitful and occasional. This ends the search as the former nature is taken as the cause and the other dismissed and rejected. Thus instances of this kind give the greatest light and the greatest authority; so that a course of interpretation sometimes ends in them and is completed through them.

It is Bacon's claim that crucial instances give light that seems to suggest they are experiments. Moreover, since illuminating experiments shed light on the laws of simple natures, it seems that crucial instances are *illuminating* experiments. This view is further supported by Bacon's claim in this passage that, just like illuminating experiments, crucial instances may reveal the form of a simple nature.

In the main body of the aphorism, Bacon provides at least ten examples of crucial instances. Some of his examples support this view, namely that '*instantiae crucis*' refers to the experiments that provide the facts necessary for a decision at a theoretical crossroads. In his discussion of the form of weight or heaviness, for example, Bacon identifies a "fork in the road:" "Heavy and weighty things must necessarily either tend of their own nature towards the centre of the earth because of their own structure; or be attracted and drawn by the physical mass of the earth itself as by an agglomeration or connatural bodies, borne towards it by agreement."

After elaborating the second alternative, Bacon notes that "a *crucial instance* on this matter could be as follows:"

> Take one of those clocks which move by lead weights, and one of those which move by a compressed iron spring; and let them be accurately tested…; then let the clock that moves by weight be placed on the top of a very high church, the other kept below; and let it be noted whether the higher clock moves more slowly than it did because the weights have less power. Let the same experiment be done at the bottom of mines deep below the earth, to see whether a clock of this kind does not move faster than it did, because the weights have increased power. If it is found that the power of the weights decreases at a height and increases under the earth, attraction from the physical mass of the earth may be taken as the cause of weight.

In this passage, Bacon clearly identifies the crucial instance in question as an experiment. He also indicates that its result establishes the fact that weight is caused by the physical mass of the earth.

In addition to this example—Bacon's fifth—his seventh strongly supports this interpretation of '*instantiae crucis*'. Among the "*crucial instances*" that may be used to determine whether the physical substance of the moon is "light, fiery or airy…or solid and dense," Bacon provides "the experiment…of letting the rays of the sun pierce through a hole on to a dusky flame" as an example. This interpretation is clearly supported, furthermore, by Bacon's sixth, eighth, and tenth examples.

By contrast, some of Bacon's other examples suggest that the term '*instantiae crucis*' refers to observations of facts necessary to decide between equally plausible alternatives. Bacon's first example supports this interpretation of the term. According to him, tides are caused "either by a forward-and-backward movement of the waters, like water sloshing back and forth in a basin, which leaves one side of the basin when it covers the other, or by the waters rising and subsiding from the depths, like water boiling up and then subsiding."

After commenting on the state of the investigation into this nature that has given rise to this "fork in the road," Bacon announces, "and so we have come to a *crucial instance* on this subject. Here it is:"

> if it is found for certain that when it is high tide on the opposing shores of both Florida and Spain in the Atlantic Sea, there is at the same time high tide on the shores of Peru and near the mainland of China in the Southern Sea; then by this *decisive instance* must certainly reject the assertion that the ebb and flow of the sea (the subject of the inquiry) occurs by a forward motion; there is no other sea or place remaining where there could be a retreat or ebb at the same time.

Bacon goes on to detail an experiment that would affirm the antecedent of this conditional. What he describes is an experiment that would allow the experimenter to observe a fact that would make it possible to decisively determine which alternative is correct. In this case, the experiment is a simple survey asking "of the inhabitants of Panama and Lima (where the two Oceans, the Atlantic and the

Southern, are separated by a small Isthmus) whether the ebb and flow of the sea on the two sides of the Isthmus occur at the same time or not." Since it reveals the simple nature of tides, this experiment, conducted at a theoretical crossroads when the correct path is indeterminate, is an illuminating experiment.[26]

Bacon's second example is similar. Under consideration in this example is whether the tide is caused by a magnetic force that attracts and draws up the seawater. As Bacon notes, "the *crucial instance* on this subject" is this:

> if it is found that in the ebbs of the sea the surface of the waters in the sea is more arched and rounded as the waters rise in the middle of the sea and fall away at the edges, which are the shores; and in the flows the same surface is planer and flatter when the waters return to their former position; then by this *decisive instance* we can certainly accept raising by magnetic force; otherwise it has to be totally rejected.

Just as in the immediately previous example, in this example the crucial instance refers to the observations of facts that allow for the matter to be decisively determined. These facts can be observed through an illuminating experiment "making use of sounding lines in straits…to find out whether towards the centre of the sea the water is higher or deeper in ebbs than in flows." In addition to these two examples, Bacon's third example supports this interpretation of '*instantiae crucis*'.[27]

Given these analyses, it is plausible to interpret crucial instances as either the instruments that establish the facts that must be established in order to decide between equally plausible alternatives or the observation of these facts. On the latter, less common interpretation, illuminating experiments might provide these facts by hastening their very observation through the intervention upon nature. In the final analysis, then, Bacon's discussion in the *New Organon* at II.XXXVI can be taken to suggest that illuminating experiments should be conducted at theoretical crossroads where the correct path is indeterminate.

Although it seems that no member of the Royal Society of London interpreted Bacon's discussion in this way, it seems to be the case that Kant did. A lifelong student of natural philosophy, Kant owned a copy of the *New Organon*, as Arthur Warda's inventory of his personal library shows.[28] Moreover, Kant's aim in the *Critique* is unmistakably Baconian, as its motto makes clear, namely to establish a scientific philosophy that claims "nothing infinite, and nothing beyond what is mortal," but only the end of "infinite errors."[29]

In what remains, I argue that his method therein is might also be Baconian. In the *Critique*, Kant seems to imitate Bacon's new scientific method, insofar as he conducts an illuminating experiment at a theoretical crossroads in order to establish the facts necessary to decisively decide between equally plausible alternatives.[30] This experiment, the experiment of pure reason (*Experiment der reinen Vernunft*), requires the philosopher to intervene upon pure reason's natural ratiocination in order to observe the facts necessary to decisively determine the correctness of the doctrine of transcendental idealism over against the doctrine of transcendental realism.[31]

The Antinomy of Pure Reason and the Experiment of Pure Reason

The task of removing the obscurity of the *Critique* that Kant began in the *Prolegomena* continued four years later. In an effort to "remove as far as possible those difficulties and obscurities from which may have sprung several misunderstandings into which acute men…have fallen in their judgment of this book," Kant rewrote many portions of the *Critique* either in whole or in part.[32] Perhaps most significantly, Kant composed a new Preface.

In it, Kant claims that the *Critique* "is a treatise on the method," but not the science, of metaphysics.[33] The new Preface also provides the architectonic of at least the first main part of the treatise, namely the Transcendental Doctrine of Elements; the second main division is the Transcendental Doctrine of Method. Both the Transcendental Aesthetic and the Transcendental Analytic provide the apodictic proof of the revolutionary hypothesis of transcendental idealism that Kant first introduces in the new Preface.[34] As Kant points out, this hypothesis, which, while merely imitating the revolutionary hypotheses of geometry and physics, is "just like the first thoughts of Copernicus."[35]

In order to understand what Kant means by this claim, it is necessary to go beyond the historical debate about just what the first thoughts of Copernicus are to which the former refers.[36] This is because the lesson Kant draws from Copernicus is both epistemological and, I think more importantly, metaphysical, such that no matter what kind of motion is assigned to the earth, what can be known in astronomy, namely the motion of the celestial host, is not only put into the stars by the (movement of the) knower, but also that what is known is only an *appearance* given in experience.

Reading Kant in this way makes better sense of the introduction of his own revolutionary hypothesis in the new Preface. Regarding the intuition of objects, Kant claims, "if intuition has to conform to the constitution of objects, then I do not see how we can know anything about them *a priori*; but if the object (as an object of the senses) conforms to the constitution of our faculty of intuition, then I can very well represent the possibility to myself."[37] Moreover, regarding the thought or determination of objects, Kant claims,

> I can assume either that the concepts through which I bring about this determination also conform to the objects, and then I am once again in the same difficulty about how I could know anything about them *a priori*, or else I assume that the objects, or what is the same thing, the experience in which alone they can be cognized (as given objects) conforms to those concepts, in which case I immediately see an easier way out of the difficulty, since experience itself is a kind of cognition requiring the understanding, whose rule I have to presuppose in myself before objects are given to me, hence *a priori*, which rule is expressed in concepts *a priori*, to which all objects of experience must therefore necessarily conform, and with which they must agree.[38]

Here, Kant emphasizes not only that what is known about objects *a priori* is limited to what is put into them by the knower or, what is the same thing, that objects must conform to human cognition. He also emphasizes a metaphysical point about the object of knowledge. Accordingly, only objects that appear in experience can be cognized. This is why Kant contrasts objects of possible experience, namely those given through sensible intuition, with objects "that cannot be given in experience at all," and therefore cannot be cognized *a priori*.[39]

That these remarks follow the reference to Copernicus in the *Critique* is more than mere coincidence, and suggests that Kant's hypothesis is informed by his metephysico-epistemological understanding of Copernicus' own hypothesis. On this view, Kant's hypothesis is the doctrine of transcendental idealism, namely that what can be *known* about objects as *appearances* is only what is put into them by the knower or, what is the same, that objects as *appearances* conform to human *cognition*. Importantly, this interpretation sufficiently distinguishes the proposed revolution in the manner of thinking in metaphysics from the revolutions in the manner of thinking in geometry and physics. It does so by emphasizing the metaphysical nature of the object of knowledge to which Kant apparently believes the "first thoughts" of Copernicus refers. The assumption common to both geometry and physics, namely that objects conform to human cognition, is epistemological and imply nothing regarding the metaphysical nature of the object of knowledge.[40] To assume that an object conforms to human cognition does not necessarily imply that the object of cognition is an appearance. To be sure, the demonstration of the isosceles triangle requires the construction of a "real" triangle that conforms to human cognition such that what is known about the object is put into it by the knower, though this triangle may or may not be an appearance. Hence, to the extent that Kant's revolutionary hypothesis is epistemological, it imitates the revolutions in geometry and physics; to the extent that it is also metaphysical, it is just like what Kant understood to be the "first thoughts" of Copernicus.

It is in this new Preface that Kant also first introduces the experiment of pure reason (*Experiment der reinen Vernunft*).[41] As he describes it in this place, the experiment of pure reason is intended to *verify* the truth of his revolutionary hypothesis, namely the doctrine of transcendental idealism. Kant's admission that the truth of his revolutionary hypothesis requires verification seems at odds with his note, also in the new Preface, that it is proved "*apodictically* from the constitution of our representation of space and time and from the elementary concepts of the understanding."[42] For, it seems that nothing apodictically proven needs verification, the latter being unnecessary in light of the former.

In this context, it is important to note that Kant understands the term 'hypothesis' to refer to at least two kinds of claims. Throughout his various lectures on logic, Kant underscores over and over again that an hypothesis is a claim either about the way the world actually is or that allows one to adequately explain some true feature of the world. Elsewhere, I discuss at length in what the apodictic proof of each kind of hypothesis consists.[43] Since Kant's revolutionary hypothesis is offered not as a true judgment about the world, but merely as an adequate way to explain how synthetic *a*

priori cognition is possible in the world, it will suffice to summarize the necessary conditions for the apodictic proof of an hypothesis as a worthy explanation.

The Transcendental Doctrine of Method contains a discussion of hypothesis understood in this latter sense. In this place, Kant enumerates the necessary requirements for the apodictic proof of a judgment that adequately explains some true feature of nature. The first of these requirements is given in the *Critique* at A770/B798.

> If the imagination is not simply to enthuse but is, under the strict oversight of reason, to invent, there must first be something that is fully certain, and not invented as a mere opinion, and that is the possibility of the object itself. With this it is possible to take refuge in opinion concerning the actuality of the object, which opinion, however, in order not to be groundless, must be connected as a ground of explanation with that which is actually given and consequently certain, and then the object as ground of explanation is then called a hypothesis.

In addition, "a second point…is requisite to make an hypothesis worthy of being assumed," namely "its adequacy for determining [*bestimmen*] *a priori* the given consequences."[44]

Although Kant explicitly identifies two necessary requirements for the apodictic proof of a judgment as an adequate hypothesis in these pages, Robert Butts claims that, "the two conditions for an adequate hypothesis that Kant lists are actually only one, since the explication that he gives for the notion of establishing as a certainty the "possibility of the object itself" is indistinguishable from the account he gives of "accounting *a priori* for an event."[45] Butts' argument can be reconstructed from the following passage:

> A hypothesis about the course of nature is allowable if (1) we 'know at least something by means of which the judgment…secures connection with truth,' and if we can establish something as certain, namely, 'the possibility of the object itself'. In addition, the hypothesis must 'account for' what is given, that is, must explain this given.' Furthermore, (2) the explanation must rest on an *a priori* basis, since only *a priori* explanatory principles are universal and necessary, the distinguishing marks of truth lacking in merely inductive generalizations.[46]

Accordingly,

1. According to Kant, a hypothesis must meet two conditions in order to be worthy of being assumed.
2. The first is that a hypothesis must establish with certainty the possibility of an object.
3. The second is that a hypothesis must account *a priori* for an event.
4. Accounting for something *a priori* is to show that it is determinable by the synthetic *a priori* principles of the understanding.

5. But this is just to establish with certainty that something is a possible experience.
6. Hence, to establish with certainty the possibility of an object is to account for it *a priori*.
7. Therefore, the two conditions that Kant lists are indistinguishable.

The nerve of this argument is the second premise, namely that an adequate hypothesis establishes with certainty the possibility of an object. On Butts' view, an adequate hypothesis explains *a priori* "what" is given, the *explanandum*, which is an object of possible experience, or what is the same, an event.

This is not Kant's view. Kant's view is rather that the object of possible experience is the *explanans* of an event, which in turn is the *explanandum*. An adequate hypothesis, then, explains an event *a priori* in terms of an object of possible experience. For this, it must be demonstrated that the connection between the object of possible experience that is the ground of explanation and the given consequence is certain. While Kant does not indicate how such a demonstration proceeds, perhaps it proceeds by linking the *explanans* and *explanandum* via the dynamical principles of the understanding, namely the synthetic *a priori* principles that are used to regulate the interaction of objects of possible experience.[47]

In addition, Kant claims that the apodictic proof of a judgment as an adequate hypothesis must demonstrate that the ground of explanation is an object of possible experience. As Kant succinctly explains,

> It is only possible for our reason to use the conditions of possible experience as conditions of the possibility of things; but it is by no means possible for reason as it were to create new ones, independent of these conditions, for concepts of this sort, although free of contradiction, would nevertheless also be without any object.[48]

Again, Kant does not indicate in what this proof consists. Perhaps it proceeds by showing that the ground of explanation is determinable by the mathematical principles of the understanding, namely the synthetic *a priori* principles of the understanding that are used to constitute objects of possible experience.[49]

In the final analysis, *pace* Butts, there are, in fact, two necessary requirements for the apodictic proof of a judgment as an adequate explanation of nature. Given this discussion in the *Critique* and the purpose of its revolutionary hypothesis, it is possible to determine in what the apodictic proof of Kant's revolutionary hypothesis most likely consists. Kant's thinking is most likely that the Transcendental Aesthetic and the Transcendental Analytic satisfy the necessary requirements for the apodictic proof that a judgment may serve as a hypothesis as expressed throughout his lectures on logic.

According to the first requirement, what the judgment expresses must be possible. The apodictic proof of Kant's hypothesis must demonstrate, then, the

possibility of objects as appearances. According to Kant, the Transcendental Aesthetic as a whole proves that objects as appearances are possible:

> We have sufficiently proved in the Transcendental Aesthetic that everything intuited in space or in time, hence all objects of an experience possible for us, are nothing but appearances, i.e., mere representations, which, as they are represented, as extended beings or series of alterations, have outside our thoughts no existence grounded in themselves.[50]

The apodictic proof of Kant's hypothesis must also demonstrate the possibility that what is known about objects as appearances is only what is put into them by the knower. Both the Transcendental Aesthetic and the Transcendental Analytic prove this possibility. The Transcendental Aesthetic proves that what can be cognized of an object as appearance is space and time, the forms of human intuition.[51] The Transcendental Analytic, and specifically §§20-21 of the Transcendental Deduction therein, proves that what can be cognized of an object as appearance are the concepts of the understanding, the forms of human thinking: "in the transcendental deduction" the possibility of the pure concepts of the understanding in general "as *a priori* cognitions of objects of an intuition in general [is] exhibited (§§20, 21)."[52]

According to the second necessary requirement, the connection between the hypothesis and its consequence must be certain. Since Kant's hypothesis explains the possibility of synthetic *a priori* cognition, the apodictic proof of the hypothesis must demonstrate the connection between synthetic *a priori* cognition and objects as appearances that conform to human cognition. The Transcendental Analytic proves that there is a connection between synthetic *a priori* cognition and objects as appearances that conform to human cognition. This is especially evident in the Second Chapter of the Analytic of Principles, "which deals with those synthetic judgments that flow *a priori* from pure concepts of the understanding under [sensible] conditions and ground all other cognitions *a priori*, i.e., with the principles of pure understanding."[53] In this place, Kant "exhibits the judgments that the understanding actually brings about *a priori*" about objects as appearances.[54] For example, the Axioms of Intuition exhibit the judgment that "all appearances are, as regards their intuition, extensive magnitudes," as in the first edition, or "all intuitions are extensive magnitudes," as in the second.[55]

The necessary requirement that the consequence must be actual does not make up part of the apodictic proof that the judgment that what can be known of objects as appearances is only what is put into them by the knower or that objects as appearances conform to human cognition may serve as an hypothesis. This is because Kant proves that synthetic *a priori* cognition is actual in the *Prolegomena*.[56] In the Introduction to the *Critique* Kant adapts this discussion, proving "synthetic *a priori* judgments are contained as principles in all theoretical sciences of reason," including mathematics and natural science.[57]

Given that, for Kant, one way to apodictically prove an hypothesis is to show that it is adequate as an explanation of some true feature of the world, the result of the

main argument of the Transcendental Aesthetic and the Transcendental Analytic is really quite limited. The main thrust of the these two sections is not that the revolutionary hypothesis is a certainly (or even probabilistically) true claim about the world, but rather that it is a claim that should be taken seriously as an explanation of how synthetic *a priori* cognition is possible in the world. In sum, the apodictic proof Kant offers in the Transcendental Aesthetic and the Transcendental Analytic shows that the doctrine of transcendental idealism is a worthy alternative to the doctrine of transcendental realism, which Kant believed to be the fundamental principle of the metaphysics of his day.

In order, then, to show that the doctrine of transcendental idealism is actually preferable to the doctrine of transcendental realism, its worthiness must be verified. To decisively determine between these two alternatives, Kant undertakes the experiment of pure reason. As Kant makes clear, both in the *Critique* and his posthumously published Prize Essay on the real progress on metaphysics since the time of Leibniz and Wolff, the experiment occurs in the Antinomy of Pure Reason, part of the Transcendental Dialectic.[58]

To be able to call the experiment of pure reason a Baconian illuminating experiment, the former must occur at a theoretical crossroads. That the Antinomy of Pure Reason is a theoretical crossroads is suggested, first, by the fact that it is situated between the Transcendental Aesthetic and the Transcendental Analytic, on the one hand, and the Transcendental Doctrine of Method, on the other.

While the Transcendental Aesthetic and Transcendental Analytic demonstrate that it is a plausible alternative to the doctrine of transcendental realism, the Transcendental Doctrine of Method *assumes as true* the doctrine of transcendental idealism. In the latter, Kant discusses how to generate and connect into a system synthetic *a priori* judgments about objects understood precisely as appearances. This feature of the Transcendental Doctrine of Method is also underscored by Jean Grondin. Asking after the conclusion of the *Critique*, he notes:

> The inaugural division of Kant's transcendental critique is that between a theory of elements and a theory of method. If the Methodology has the honor of being the last section of the book, it is because the very idea of a theory of method is intimately linked to the original project of a *critique of pure reason*. The *Critique* defined itself, we remember, as a "treatise on method" that aims at a fundamental revolution in metaphysics by exposing the corner stone of metaphysical cognitions. In its very conception, the *critique of pure reason* has no other task than to revolutionize metaphysics by proposing a new methodology that could lay the foundations for a rigorous metaphysics. It then seems appropriate to learn anew to see in the Methodology the logical outcomes of Kant's critical investigation. By exaggerating only slightly, one could claim that the transcendental theory of elements had no other object than to sort out the elements of pure reason. The original import of the *Critique* could then be found in its Methodology. What is undoubtable is that

> the institution of a new metaphysics did not take place anywhere in the transcendental theory of elements.[59]

That the Antinomy of Pure Reason is a theoretical crossroads is further suggested by the fact that it is the only chapter in the second edition of the Transcendental Dialectic that explicitly endorses the doctrine of transcendental idealism over the doctrine of transcendental realism. As Kant clarifies in his new Preface, only those portions of the *Critique* for which the mode of presentation in the first edition caused misunderstanding were revised for the second. And only the mode of presentation was revised in these portions. Accordingly, Kant's revisions aimed to "remove, first, the misunderstanding of the Aesthetic, chiefly the one in the concept of time; second, the obscurity in the Deduction of the Concepts of the Understanding, next the supposed lack of sufficient evidence in the proofs of the Principle of Pure Understanding, and finally the misinterpretation of the paralogisms advanced against rational psychology."[60]

Relevant to the present purpose, it is important to note that the Paralogisms of Pure Reason is the only part of the Transcendental Dialectic that Kant revised for the second edition of the *Critique*.[61] As it appears in the second edition, this chapter of the Transcendental Dialectic is only thirty-three pages in length, compared to the sixty-four pages of the chapter in the first edition. Among the omissions in the second edition is Kant's discussion of two kinds of idealism, namely transcendental idealism (empirical realism) and empirical idealism (transcendental realism) that begins at A369. This discussion culminates in the explicit endorsement of the former over the latter: rational psychology is possible only on the presupposition that its object of cognition, namely the soul, is an appearance and not a thing in itself.

> If, therefore, as the present critique requires of us, we remain true to the rule established earlier not to press our questions beyond that with which possible experience and its object can supply us, then it will not occur to us to seek information about what the objects of our senses may be in themselves, i.e., apart from any relation to the senses. But if a psychologist takes appearances for things in themselves then as a materialist he may take up matter into his doctrine, or as a spiritualist he may take up merely thinking beings (namely, according to the form of our inner sense) as a single and sole thing existing in itself, or as a dualist he may take up both; yet through misunderstanding he will always be confined to sophistical reasonings about the way in which that which is no thing in itself, but only appearance of a thing in general, might exist in itself.[62]

In the second edition, the conclusion of the Paralogisms of Pure Reason is different in its emphasis, which does not even implicitly endorse the doctrine of transcendental idealism. "The dialectical illusion in rational psychology rests on the confusion of an idea of reason (of a pure intelligence) with the concept, in every way indeterminate, of a thinking thing in general."[63]

Both the Antinomy of Pure Reason and the Ideal of Pure Reason appear in the second edition of the *Critique* as they appeared in its first edition, save sparse and very minor grammatical and stylistic revisions. In neither edition of the Ideal of Pure Reason does Kant explicitly discuss the doctrines of transcendental idealism and transcendental realism. He does, however, discuss the different kinds of theoretical cognition. On the one hand, a theoretical cognition is speculative "if it pertains to an object or concepts of an object to which one cannot attain in any experience; on the other hand, there is cognition of nature, "which pertains to no objects, or their predicates, except those that can be given in a possible experience."[64] Kant goes on to claim that the speculative use of pure reason is null and void in theology, just as the natural use of pure reason does not even constitute a theology.[65] Even if speculative cognition presupposed the doctrine of transcendental realism, and natural cognition the doctrine of transcendental idealism, the Ideal of Pure Reason nevertheless lacks even an implicit endorsement of the latter doctrine.

The situation is different in the Antinomy of Pure Reason. In this place, Kant claims that the chapter offers an indirect proof of the doctrine of transcendental idealism,[66] according to which "everything intuited in space or in time, hence all objects of an experience possible for us, are nothing but appearances, i.e., mere representations, which, as they are represented, as extended beings or series of alterations, have outside our thoughts no existence grounded in itself."[67] The proof, according to Kant, consists in the following dilemma:

> If the world is a whole existing in itself, then it is either finite or infinite. Now the first as well as the second alternative is false (according to the proof offered above for the antithesis on the one side and the thesis on the other). Thus it is also false that the world (the sum total of all appearances) is a whole existing in itself. From which it follows that appearances in general are nothing outside our representations, which is just what we mean by their transcendental ideality.[68]

As I argued above, illuminating experiments bring to the awareness of the experimenter the facts necessary to decisively determine between equally plausible alternatives. In these cases, the experimenter more or less intervenes upon nature in order to observe these facts.[69] Not only does the experiment of pure reason occur at a theoretical crossroads, but it is also conducted in order to decisively determine between two equally plausible alternatives. As Kant puts it, "if we…find that there is agreement with the principle of pure reason when things are considered from this twofold perspective [*aus jenem doppelten Gesichtspunkte*], but that an unavoidable conflict of reason with itself arises with a single standpoint [*bei einerlei Gesichtspunkte*], then the experiment decides for the correctness of that distinction" of things into objects of experience and objects beyond experience over against the rival doctrine of transcendental realism.[70] What is more, the experiment of pure reason requires the philosopher to intervene upon the *natural* ratiocination of pure reason in order to make this determination.

According to Kant, the experiment of pure reason, which he describes in the Antinomy of Pure Reason as an experimental evaluation of the principle (*Prüfungsversuch der Nomothetik*) that grounds the seemingly contradictory propositions of pure reason, follows the skeptical method.[71] Such a method makes it is possible "to do as wise legislators do when from the embarrassment of judges in cases of litigation they draw instruction concerning that which is defective and inaccurately determined in their laws…in order to make reason…*attentive* to the moments involved in determining its principles."[72] The experiment of pure reason essentially has three stages.

The application of the skeptical method requires in the first instance, "the origination [*veranlassen*] of a contest" between the antithetical propositions of pure reason as regards the nature of the unconditioned condition of each series given in the world.[73] Not only is it the pure reason of the philosopher that generates these antithetical propositions, it is the same pure reason that lines up (*anstellen*), observes, and even comments upon the contest.[74] The contest itself consists in pure reason's earnest attempt to prove each proposition over and against its respective contradiction.

According to pure reason, the world is and is not bounded temporally or spatially; the world is and is not constituted of infinitely divisible parts; there is and is not freedom in the world; and there is and is not an absolutely necessary being that is the cause of the world. Employing the method of proof *modus tollens*, pure reason posits a *natural* disjunction regarding the unconditioned; to be sure, Kant underscores in the *Prolegomena* that the "antinomy…is grounded in the nature of human reason."[75] Pure reason then reflects on the implications of each. By thus intervening upon the natural ratiocination of pure reason, the philosopher is able to uncover at least one absurdity that each of its propositions about the unconditioned implies. The result is a recursive vacillation such that pure reason is ultimately unable to affirm any thesis or antithesis.

Since there is no warrant to affirm any thesis over any antithesis, or *vice versa*, based on their proofs, the philosopher must further intervene upon the natural ratiocination of pure reason and examine the antithetical propositions of pure reason themselves. This is the second stage of the experiment of pure reason.[76] This examination reveals to the pure reason of the philosopher whether and how the principle that ultimately grounds these propositions misconceives how objects of experience are given. If so, then not only is the grounding principle false, so too are all the propositions of pure reason about the unconditioned that it grounds.

This is exactly what the experiment of pure reason reveals to the philosopher. According to the grounding principle of the antithetic propositions of pure reason, if the conditioned is given in experience *as a thing in itself*, then the complete series of conditions, hence the unconditioned, is also given in experience as a thing in itself. However, neither the conditioned nor the unconditioned are given in experience as things in themselves. Rather, the conditioned is given in experience as an appearance, and the unconditioned is not given at all in experience.

In the third stage of the experiment of pure reason, the philosopher must not only determine anew the fundamental principle of cosmology, but also verify that the

new principle is devoid of any defects.[77] As Kant suggests, the pure reason of the philosopher is driven to replace its *a priori* concepts and principles that determine objects through mere reason and from a single standpoint with the *a priori* concepts and principles that allow objects to be considered as both objects of experience and objects beyond experience.[78] This is because, in ultimately affirming the doctrine of transcendental idealism, the pure reason of the philosopher preserves the insights of empiricism and the dogmatism of pure reason while correcting their respective defects. As with the principle of empiricism, the doctrine of transcendental idealism affirms that objects of knowledge are sensible; however, the doctrine of transcendental idealism also affirms that these objects are appearances, and not things in themselves. As with the principle of intellectualism, the doctrine of transcendental idealism affirms that objects of knowledge are things in themselves; however, the doctrine of transcendental idealism maintains that these objects cannot be given in possible experience.

Finally, in order to verify that this principle, namely the doctrine of transcendental idealism, is properly formulated, the pure reason of the philosopher initiates a new contest between the antithetical propositions of pure reason as regards the nature of the unconditioned condition of each series given in the world. This time, however, the philosopher discovers that it is possible to affirm two propositions over against their respective contradiction. Pure reason affirms that there is freedom in the world and that there is an absolutely necessary being that is the cause of the world. This is because each proposition is consistent with the newly formulated principle of transcendental idealism. Hence, Kant's revolutionary hypothesis—the doctrine of transcendental idealism—is worthy of being taken as the fundamental principle of a scientific philosophy.

Conclusion

In the *Critique*, Kant set himself the task of revolutionizing the method of theoretical philosophy in the hopes of finally establishing it as science. Heretofore, as Kant claims in his Preface to its second edition, metaphysics has proceeded on the assumption that cognition must conform to objects; "but all attempts to find out something about them *a priori* through concepts that would extend our cognition have, on this presupposition, come to nothing."[79] Not only imitating the epistemological revolutions that occurred in both mathematics and physics, but also the metaphysical revolution he seems to have taken Copernicus' revolution in astronomy to be, Kant proposes that metaphysics proceed on the assumption that what can be known about objects as appearances is only what is put into them by the knower, or what is the same, that objects as appearances conform to human cognition. In the first main part of the *Critique*, namely the Transcendental Doctrine of Elements, Kant is at pains not only to apodictically prove but also to verify this hypothesis.

Kant apodictically proves his revolutionary hypothesis in both the Transcendental Aesthetic and the Transcendental Analytic. This proof succeeds in establishing the plausibility of the doctrine of transcendental idealism as an alternative to the current, fundamental, methodological principle of metaphysics: the doctrine of

transcendental realism. As I have argued in this essay, the experiment of pure reason through which Kant verifies the correctness of this doctrine can be considered a Baconian illuminating experiment, 1) as Bacon allows, illuminating experiments that intervene upon nature should be performed at a theoretical crossroads in order to make observable to the experimenter the facts necessary to determine which of available, plausible alternatives is correct; 2) given at least two important features of the *Critique of Pure Reason*, the Antinomy of Pure Reason is a theoretical crossroads about the fundamental principle that will allow metaphysics to become a science; and 3) the experiment of pure reason requires the philosopher to intervene upon pure reason's natural ratiocination in order to observe the facts necessary to decisively determine the correctness of the doctrine of transcendental idealism over against the doctrine of transcendental realism.

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[1] Cf.: Bacon, F., *The New Organon* (Cambridge: Cambridge University Press, 2008), II.XXI.

[2] Bacon, F., *The New Organon,* I.XXXVIII.

[3] Bacon, F., *The New Organon,* I.XIV.

[4] References to the *Critique of Pure Reason*, hereafter *Critique*, are given according to custom by the pagination of the first ("A") and second ("B") editions of 1781 and 1787, respectively; if the cited passage is included in both editions, the citation includes both the A and B page references. References to other works of Kant are according to the German Academy ("AA") edition pagination: *Gesammelte Schriften*, ed. Königlich Preußischen Akademie der Wissenschaften (later Deutschen Akademie der Wissenschaften zu Berlin) (Berlin: Walter de Gruyter, 1900-); citations include the volume number followed the page number(s). Unless otherwise indicated, English translations of Kant's works are from Paul Guyer and Allen W. Wood, eds., *The Cambridge Edition of the Works of Immanuel Kant* (Cambridge: Cambridge University Press, 1998-), the margins of which reference the German Academy edition. In these endnotes, I use the following abbreviations:

JL = Jäsche Logic
KrV = Critique of Pure Reason
LL = Lectures on Logic
Prol = Prolegomena to Any Future Metaphysics That May Lay Claim to Being a Science (cited in-text as *Prolegomena*)
PE = What real progress has metaphysics made in Germany since the time of Leibniz and Wolff?

[5] For references to Bacon *in passim*, see Kant, *LL*, AA 24: 804, and *JL*, AA 9: 32. Kant's motto for the second edition of the *Critique* comes from the Preface to the *New Organon*: "Of our own person we will say nothing. But as to the subject matter with which we are concerned, we ask that men think of it not as an opinion but as a work; and consider it erected not for any sect of ours, or for our good pleasure, but as the foundation of human utility and dignity. Each individual equally, then, may reflect on it himself…for his own part…in the common interest. Further, each may well hope from our instauration that it claims nothing infinite, and noting beyond what is mortal; for in truth it prescribes only the end of infinite errors, and this is a legitimate end" (Kant, I., *KrV*, Bii).

[6] Kant, I., *KrV*, Bxviii. Like Newton, who feigned no hypotheses, Kant, in his Preface to the first edition of the *Critique*, claims, "in this kind of inquiry it is in no way allowed to opine, and

that anything that even looks like an hypothesis is a forbidden commodity, which should not be put up for sale even at the lowest price but must be confiscated as soon as it is discovered" (*KrV*, Axv). When stripped of its rhetorical garb, this passage is consistent with his use of hypothesis in the *Critique* (cf.: *KrV*, Bxxii). In this passage, "hypothesis" is a synonym for "opinion," and "hypothesize" a synonym for "opine."

[7] Bacon, F., *The New Organon,* II.XVII.

[8] Cf.: Bacon, F., *The New Organon*, II.X.

[9] Bacon, F., *The New Organon,* II.XI.

[10] Gaukroger, S., *Francis Bacon and the Transformation of Early-Modern Philosophy* (Cambridge: Cambridge University Press, 2001), 145.

[11] Bacon, F., *The New Organon,* II.XII.

[12] Bacon, F., *The New Organon*, II.XIII.

[13] Bacon, F., *The New Organon,* II. XIX.

[14] Cf.: Bacon, F., *The New Organon,* II.XVIII. Examples of exclusion of natures from the form of heat include: "5. By boiling water and air, and also by metals and other solids which have been warmed but not to the point of catching fire or redness, *reject* light and brightness."

[15] Bacon, F., *The New Organon,* II.XX.

[16] Bacon, F., *The New Organon,* II.XX. In this place, Bacon also provides what he calls "the true form or definition of heat:" namely, "an expansive motion which is checked and struggling through the particles." It is well to ask whether, and indeed exactly how, Bacon reaps this harvest from the seeds he sowed in Tables 1-3. Nevertheless, these and similar critical questions lie beyond the scope of the present study, the aim of which is simply to sketch, in very general terms, Bacon's method of true induction and the role of illuminating experiments therein. For a good critical discussion of Bacon's method of induction, see Gaukroger, S., (2001), 148ff.

[17] Bacon, F., *The New Organon,* II.XXI.

[18] The ambiguity of this section is highlighted in its last sentence, where Bacon writes:

> Atque de Instantiis Crucis hæc dicta sint. Longiores autem in iis tractandis as hunc finem fuimus, ut hominess paulatim discant & assuefiant de natura judicare per Instantias Crucis & experimenta lucifera, & non per rationes probabiles.

It is important to note that the passage in question contains three ampersands. The ampersand can signify both conjunction and apposition. Although Bacon obviously uses the first and third occurrences of the ampersand to signify conjunction, i.e., the bringing together two different things in comparison or contrast, there is no guarantee that it was his intention to use the second occurrence in this way. Hence, there are two grammatically correct ways of interpreting this sentence. First, Bacon is renaming crucial instances as illuminating experiments. Second, Bacon is conjoining crucial instances and illuminating experiments, noting that these two different things help in the forming of judgments about natures.

[19] Boyle, R., *A Defence of the Doctrine Touching the Spring and Weight of the Air*, in *The Works of Robert Boyle: The Usefulness of Natural Philosophy and Sequels to Spring of the Air, 1662-1663*, eds. M. Hunter and E.B. Davis (London: Pickering & Chatto, 1999-2000), 50.

Pascal began a series of experiments on the vacuum in 1646. Two years later, on 19 September, Pascal's brother-in-law, and not Pascal himself as Boyle notes, performed the famous experiment atop the Puy-de-Dôme, a large lava dome in south-central France. Interestingly, in a letter to Princess Elizabeth, dated 31 January 1648, René Descartes notes that he (most likely on 24 September 2647) "advised M. Pascal to do an experiment to see whether the mercury rises as high on the top of a mountain as at its foot, and I do not know

whether he has done it" (Descartes, R., *The Philosophical Writings of Descartes, Volume III: The Correspondence*, trans. J. Cottingham, R. Stoothoff, D. Murdoch, and A. Kenny (Cambridge: Cambridge University Press, 1991), 328). Descartes makes the same point in a letter to Pierre de Carcavi, a French government officer, dated 17 August 1649 (cf.: Descartes, R., *The Philosophical Writings of Descartes, Volume III*, 380).

[20] Boyle, R., *A Defence of the Doctrine,* 50.

[21] Sabra, A.I., *Theories of Light from Descartes to Newton* (London: Oldbourne Book Co., Ltd., 1967), 249. "The methodological procedure of '*instantiae crucis*'" is discussed by Michael Ben-Chaim in Ben-Chaim, M., *Experimental Philosophy and the Birth of Empirical Science: Boyle, Locke, and Newton* (Hampshire: Ashgate, 2004), 84ff.

[22] Hacking, I. *Representing and Intervening: Introductory Topics in the Philosophy of Natural Science* (Cambridge: Cambridge University Press, 1983), 249.

[23] Cantor, G., "The Rhetoric of Experiment," in *The Uses of Experiment: Studies in the Natural Sciences*, eds. D. Gooding, T. Pinch, and S. Schaffer (Cambridge: Cambridge University Press, 1989), 177. Cantor's quotation is from Bacon, II.XXXVI, quoted in Hacking, 250.

[24] Gower, B., *Scientific Method: An Historical and Philosophical Introduction* (London: Routledge, 1997), 55.

[25] Sargent, R-M., "Baconian Experimentalism: Comments on McMullin's History of the Philosophy of Science," *Philosophy of Science* 68 (2001): 314.

[26] Although Bacon is silent, it is possible, with this knowledge, to perform *fruit-bearing* experiments to determine the best means of, say, flood prevention.

[27] In this example, however, Bacon does not describe the illuminating experiment that should decisively determine whether "diurnal motion whereby to our eyes the sun and stars rise and set, be a real motion of rotation in the heavenly bodies, or a motion apparent in the heavenly bodies, and real in the earth." Bacon's fourth and ninth examples are passed over, as they are ambiguous, clearly supporting neither interpretation of the term '*instantiae crucis*'.

[28] See Warda, A., *Immanuel Kants Bücher: Mit einer getreuen Nachbildung des bisher einzigen bekannten Abzuges des Versteigerungskataloges der Bibliothek Kants* (Berlin 1922), 45. Kant owned the Edwardi Griffini edition publishd in 1638.

[29] Kant, I., *KrV*, Bii.

[30] Kant proposes to imitate (*nachzuahmen*), for the purposes of transforming the accepted method of metaphysics, the essential element in the revolutions in the manner of thinking in geometry and physics (cf.: Kant, I., *KrV*, Bxvi).

[31] According to the doctrine of transcendental idealism, appearances "are all to be regarded as mere representations and not as things in themselves, and accordingly that space and time are only sensible forms of our intuition, but not determinations given for themselves or conditions of objects as things in themselves;" according to the doctrine of transcendental realism, by contrast, objects that appear in space and time are to be regarded as things in themselves, given independently of our sensibility (Kant, I., *KrV*, A369).

[32] Kant, I., *KrV*, Bxxxvii.

[33] Kant, I., *KrV*, Bxxii.

[34] Kant, I., *KrV*, Bxxii.

[35] Kant, I., *KrV*, Bxvi and ff.; see also Kant, I., *KrV*, A490/B518-A491/B519.

[36] There is no consensus among scholars about just what the first thoughts of Copernicus are to which Kant refers; some scholars take Kant to be referring to Copernicus' heliocentric hypothesis, while others believe that he is referring to Copernicus' claim that the earth rotates daily about its vertical axis. Recent literature on this issue includes Miles, M., "'Kant's Copernican Revolution': Toward Rehabilitation of a Concept and Provision of a Framework

for the Interpretation of the *Critique of Pure Reason*," *Kant-Studien* 97, no. 1 (2006): 1-32; Brandt, R., *Die Bestimmung des Menschen bei Kant* (Hamburg: Felix Meiner Verlag, 2007), esp. Chapter 5, "Kopernicus und Newton, Hypothese und Gewiβheit"; Schulting, D., "Kant's Copernican Analogy: Beyond the Non-Specific Reading", *Studi Kantiani* 22 (2009): 39-65; and Lemanski, J., "Die Königin der Revolution. Zur Rettung und Erhaltung der Kopernikanischen Wende", *Kant-Studien* 103, no. 4 (2012): 448–471.

[37] Kant, I., *KrV*, Bxvii.

[38] Kant, I., *KrV*, Bxvii-Bxzviii.

[39] Kant, I., *KrV*, Bxviii.

[40] Cf.: Kant, I., *KrV*, Bxii and Bxiv.

[41] The experiment of pure reason is generally neglected in the secondary literature devoted to Kant's *Critique*. For a general overview of Kant's notion of experimentation, see the first chapter of Falkenburg, B., *Die Form der Materie: Zur Metaphysik der Natur bei Kant und Hegel* (Frankfurt: Anthäneum, 1987); Seigfried, H., "Transcendental Experiments (II): Kant and Heidegger," in *Hermeneutic Phenomenology: Lectures and Essays*, ed., J.J. Kockelmans (Washington, D.C.: Center for Advanced Research in Phenomenology & University Press of America, 1988), 123-156; Seigfried, H., "Transcendental Experiments," in *Proceedings of the Sixth International Kant Congress*, eds., G. Funke and T. Seebohm (Washington, D.C.: University Press of America, 1989), 342-350; and Gloy, K., "Kant's Philosophy and the Experiment," in *Kant in der Diskussion der Moderne*, eds. G. Schönrich and Y. Kato (Frankfurt: Suhrkamp, 1996), 64-91. Shi-Hyong Kim offers a detailed discussion of Kant's experiment of pure reason in the context of Bacon's philosophy of science in *Bacon und Kant: Ein Erkenntnistheoretischer Vergleich Zwischen dem 'Novum Organum' und der 'Kritik der reinen Vernunft'* (Frankfurt: Walter de Gruyter, 2008). Kim seems to imply that experimentation is a key feature of a new scientific philosophy. While I agree, I would underscore that experiments like that of pure reason are not to be used to further develop, but only to establish, a scientific philosophy.

[42] Kant, I., *KrV*, Bxxii. Emphasis added.

[43] See Fulkerson-Smith, B.: "On the Apodictic Proof and Validation of Kant's Revolutionary Hypothesis," *Kantian Review*, 15 (2010): 37-56.

[44] Kant, I., *KrV*, A774/B802.

[45] Butts, R., "Kant on Hypotheses in the 'Doctrine of Method' and the *Logik*," *Archiv für Geschichte der Philosophie* 44, no. 2 (1962): 189.

[46] Butts, R., (1962):189.

[47] Cf.: Kant, I., *KrV*, A148/B187-A162/B202; and A176/B218-A226/B274.

[48] Cf.: Kant, I., *KrV*, A148/B187-A162/B202; and A176/B218-A226/B274.

[49] Cf.: Kant, I., *KrV*, A162/B202-A176/B218.

[50] Kant, I., *KrV*, A490/B518-A491/B519.

[51] Cf.: Kant, I., *KrV*, A42/B60.

[52] Kant, I., *KrV*, B159.

[53] Kant, I., *KrV*, A136/B175.

[54] Kant, I., *KrV*, A148/B187.

[55] Kant, I., *KrV*, A162/B202.

[56] Kant, I., *Prol*, AA 4: 267-273.

[57] Kant, I., *KrV*, B14; cf.: B15 and ff.

[58] Cf.: Kant, I., *KrV*, Bxx and Kant, I., *PE*, AA 20: 287. The original manuscripts of the latter have been lost. Kant began working on the latter six years after the publication of the second edition of the *Critique* in answer to the question of the prize essay competition sponsored by

the Académie Royal des Sciences et des Belles-Lettres in Berlin: what real progress has metaphysics made in Germany since the time of Leibniz and Wolff? Kant's longtime editor, Friedrich Theodor Rink, eventually published this series of manuscripts in 1804 and after Kant's death, though it is believed that the latter gave them to Rink sometime between 1800 and 1802.

Although publicly announced in 1790, with a deadline for contributions of 1 January 1 1792, the competition was not concluded until 1 June 1795, having been extended due to an insufficient number of submissions; Kant neither completed nor submitted for the Academy's consideration a contribution to the prize essay competition. First prize was awarded to Johann Christoph Schwab, a Wolffian, and second prizes to Karl Leonard Reinhold and Johann Heinrich Abicht, both Kantians. Christian F. Jenisch, also a Kantian, received an honorable mention.

[59] Grondin, J., "The Conclusion of the '*Critique of Pure Reason*'," *Graduate Faculty Philosophy Journal* 16, no. 1 (1993): 168. There is a lengthier French version of this article: "La conclusion de la Critique de la raison pure," *Kant-Studien* 81, no. 2 (1990): 129-144.

[60] Kant, I., *KrV*, Bxxxviii.

[61] Kant did not revise any of the second main part of the *Critique*, namely the Transcendental Doctrine of Method.

[62] Kant, I., *KrV*, A380; see also Ibid. A382.

[63] Kant, I., *KrV*, A426.

[64] Kant, I., *KrV*, A634/B662-A635/B663.

[65] Kant, I., *KrV*, A636/B664.

[66] Cf.: Kant, I., *KrV*, A506/B534.

[67] Kant, I., *KrV*, A490/B518-A491/B19.

[68] Kant, I., *KrV*, A506/B534-A507/B535.

[69] Compare Bacon's experiments to determine the true cause of tides, discussed in the previous section.

[70] Kant, I., *KrV*, Bxviii-Bxix. Translation modified.

[71] Cf.: Kant, I., *KrV*, A423/B451ff.

[72] Kant, I., *KrV*, A423/B451-A424/B452. Emphasis added.

[73] Kant, I., *KrV*, A423/B451. Translation modified. This stage of the experiment of pure reason is found at *KrV*, A426/B454-A460/B488.

[74] Cf.: Kant, I., *KrV*, A425/B453; see also A426/B454.

[75] Kant, I., *Prol*, AA 4: 339.

[76] This stage of the experiment of pure reason is found at *KrV*, A485/B513-A507/B535.

[77] This stage of the experiment of pure reason is found at *KrV*, A508/B536-A567/B595.

[78] Compare Kant, I., *KrV*, Bxviii-xix and A462/B490 on this point.

[79] Kant, I., *KrV*, Bxi.