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The Kantian Grounding of Einstein's Worldview: (II) Simultaneity, Synthetic Apriority and the Mystical

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Abstract

Part I in this two-part series employed a perspectival interpretation to argue that Kant's epistemology serves as the philosophical grounding for modern revolutions in science. Although Einstein read Kant at an early age and immersed himself in Kant's philosophy throughout his early adulthood, he was reluctant to admit Kant's influence, possibly due to personal factors relating to his cultural-political situation. This sequel argues that Einstein's early Kant-studies would have brought to his attention the problem of simultaneity *and* the method of solving it that eventually led to the theory of relativity. Despite Einstein's reluctance to acknowledge his Kantian grounding, a perspectival understanding of Kant's philosophy of science shows it is profoundly consistent with Einstein's views on both synthetic apriority and the nature of scientific theory. Moreover, Kant and Einstein share quasi-mystical religious tendencies, relying on an unknowable absolute as the ultimate boundary of our scientific understanding of nature.

1. Kant and Einstein on Simultaneity and the Ideality of Time

This is the second in a pair of articles arguing that Immanuel Kant's philosophy, interpreted as a system of perspectives, contains within it the key features that provided a

philosophical grounding for Albert Einstein's worldview. Part I of this series[1] defines a worldview as the set of background assumptions that inform a person on such key issues as the nature of time and space, how causality functions in the empirical world, and ultimately, the nature of God and religion. We saw that Einstein read Kant as a young teenager, immersed himself in Kant's philosophy during his middle teens, and continued to return to Kant for inspiration throughout his young adulthood. Nevertheless, in his mature accounts of the influences on his intellectual development Einstein tended to downplay Kant's influence. An examination of various personal factors relating to his cultural-political situation provided an adequate explanation for why he distanced himself from Kant, despite the obvious influence Kant had on him and the urgings of many self-declared Kantians to woo Einstein into their camp. In this sequel we shall look beyond Einstein's self-portrayal of his intellectual development, in search of more concrete evidence that Kant's philosophy served as a substantive grounding for Einstein's highly original way of thinking, not merely as an accidental precursor that the young Einstein grew out of. This controversial claim would be substantially verified if evidence could be found that Einstein's early study of Kant played a formative role in his actual discovery of the theory of relativity.

Einstein was just 27 in 1905, when he published his epoch-making paper introducing the first of his two relativity theories. The aging Einstein recalls that the *paradox* that gave rise to the line of thinking that led him to propose the principle of relativity first occurred to him when he was 16—the very year he was most deeply immersed in Kant's philosophy (see Part I, §3). Einstein describes that paradox as follows:

> If I pursue a beam of light with velocity c ..., I should [according to Newtonian physics] observe such a beam of light as a spatially oscillatory electromagnetic field at rest. However, there seems to be no such thing, whether on the basis of experience or according to Maxwell's equations. From the very beginning [i.e., since age 16] it appeared to me intuitively clear that, judged from the standpoint of such an observer [i.e., one who was moving along with the beam of light], everything would have to happen according to the same laws as for an observer who, relative to the earth, was

> at rest. For how, otherwise, should the first observer know, i.e., be able to determine, that he is in a state of fast uniform motion?[2]

Einstein's dating of his first awareness of this paradox suggests that Kant, his favorite philosopher at the time, would be a likely source of inspiration, *if* Kant discusses anything relevant to this issue. Before considering this possibility, let us look briefly at Einstein's solution to this paradox, a problem arising out of his attempt to understand the strange relativity evident in our observations of *simultaneity*.

Einstein's solution to the problem of simultaneity follows an ingenious procedure: he took a *problem* that had arisen in the science of his day and treated it as a *solution* (i.e., a given result) that would be virtually self-evident if certain background assumptions were revised.[3] To those already familiar with the special theory of relativity, Einstein's background assumption seems so obvious that it is difficult to imagine how new and strange it seemed at the time. The problem facing physicists in Einstein's day was that recent discoveries in experimental and mathematical physics, as best documented by the Michelson-Morley experiment (1887), indicated that the speed of light is not affected by the motion of the object emitting it; yet this result challenged the classical notion of simultaneity[4] and thus appeared to be inconsistent with the time-honored presupposition of Newtonian physics, that space is an absolute "container" existing independently both of the objects that fill it and of time. Einstein takes this problematic result as his starting point by assuming a hypothetical person traveling at the speed of light could distinguish his or her perception from the perception of someone "at rest" only if the laws of physics (including the speed of light) are "invariant", governing both states equally. He thus took the "problem" (that simultaneity does not appear to be determinable in any absolute sense) as the *solution* to a process no previous physicist had correctly understood. By replacing Newton's notions of absolute space and time—what Einstein often called arbitrary conventions—with his new conventions, "the principle of relativity" (that all motion is relative to a given "coordinate system" or frame of reference) and the invariance of the speed of light (so that light travels the same speed whether the object emitting it is in motion or at rest),[5] these "inconsistencies" became the *expected*

outcome of the otherwise problematic experiments.

As von Weizsäcker observes, the only philosopher before Einstein to reflect deeply on the problem of simultaneity was *Kant*.[6] In §4 of the Transcendental Aesthetic Kant cites the problem of how an experience of simultaneity is possible as a key rationale for assuming that time is "a necessary representation that underlies all intuitions": "Only on the presupposition of time can we represent to ourselves a number of things as existing at one and the same time (simultaneously) or at different times (successively)."[7] He adds: "Time has only one dimension; different times are not simultaneous but successive (just as different spaces are not successive but simultaneous). These principles cannot be derived from experience, for experience would give neither strict universality nor apodeictic certainty."[8] From the fact that "different times are not simultaneous" Kant infers that time is transcendentally ideal. Furthermore, in the section of the Analytic of Principles defending the Second Analogy, he argues that the principle of causality applies to simultaneous events (causation through spatial relation) as much as to successive events (causation through temporal relation) because the category of causality must be schematized (time-related) whenever we apply it to phenomena.[9] Unfortunately, von Weizsäcker cites only this second passage, showing no awareness of Kant's earlier, more weighty appeal to simultaneity as confirming the transcendental ideality of time, as a synthetic a priori condition for the possibility of experience.[10]

Instead of comparing Einstein's approach to this problem with Kant's, von Weizsäcker, apparently unaware of young Einstein's study of the first *Critique* (see Part I, §3), merely dismisses the similarity with the remark that Einstein "could hardly have known this passage of Kant's".[11] For Kant, the problem of simultaneity was that Newtonian physics *requires* us to be able to identify events as simultaneous in certain cases, yet no appeal to empirical facts could show how this is possible. Kant solves Newton's problem by treating it as the empirical outcome we would *expect*, if we replace Newton's assumption that space and time are absolute empirical "containers" with the new assumption that space, time, and causality are synthetic a priori conditions for the possibility of experience. Kant concluded

that our experience of simultaneous events in nature thereby confirms his Copernican hypothesis as applied to time. What has heretofore gone unnoticed is that, although Kant obviously assumes a Newtonian view of simultaneity, he presents his Copernican revolution (in the second Preface to the first *Critique* and throughout the book) as following a *procedure* virtually identical to the one Einstein later followed.

Even though the physics of Kant's day did not present him with the empirical facts that prompted Einstein to propose his 1905 solution to the problem of simultaneity, Kant *did* recognize that in order to resolve the very different simultaneity paradox that did arise for Newtonian physics, one of Newton's basic assumptions had to be abandoned: space and time could no longer be regarded as absolute realities that exist apart from their relation to the human observer's mind. This fact, together with the facts regarding Einstein's early intellectual development that were detailed in Part I, leads to an intriguing inference. Einstein was probably just 13 when he first read Kant's claim that, by regarding space and time as "pure intuitions", a crucial simultaneity problem could be solved; even if he missed the significance of this claim at that point, he could not have missed it when he immersed himself in the first *Critique* three years later, at the very age when he began to reflect deeply on a new simultaneity problem that had arisen in the physics of his day. In order to solve this new version of the problem, he (like Kant) had to free himself from the Newtonian worldview that had kept physics in a straitjacket for over two centuries (i.e., the position Kant called "transcendental realism"). His reading of Kant is the best explanation of what brought this problem to his attention and freed his mind to resolve it in the way he did. What else could have prompted young Einstein to recognize *both* the paradox of simultaneity *and* the proper method to resolve it, as he did during the next decade, by replacing Newton's view of time as an absolute container for physical objects with the (Kantian) assumption that the passage of time is a mental construct?

Einstein's use of Kant's "Copernican" procedure to solve the paradox of simultaneity reaches a conclusion quite different from Kant's, because science had produced different empirical data. Kant assumed empirical simultaneity to be a real phenomenon because the

physics of his day required it. Similarly, Einstein assumed absolute simultaneity to be illusory because the physics of his day had called it into question. The differences in the empirical data the two thinkers took for granted should not prevent us from recognizing that Einstein, like Kant, took this unexplained empirical result for granted and explained it as the natural outcome we would expect on the basis of his new hypothesis, whereby time is *not* absolute (as Newton had assumed) but relative to whatever coordinate (inertial) system is presupposed by a body's movement.[12] Whereas Kant had explained how events could *appear* to us to be simultaneous by portraying time itself as a mental construct, Einstein explained how *absolute* simultaneity could turn out to be illusory by portraying time itself as relative: "There is no such thing as simultaneity of distant events; consequently there is also no such thing as immediate action at a distance in the sense of Newtonian mechanics."[13]

In a letter to the logical empiricist, Moritz Schlick (dated 14 December 1915), where Einstein agrees with Schlick's rejection of Kant's theory of the role of synthetic a priori principles in science and points to Mach and Hume as the primary influences on his development of the theory of relativity (a position we shall examine further in §§2-3, below), he adds: "the general theory of relativity" implies that "time & space lose the last vestiges of physical reality."[14] Surprisingly, Einstein does not acknowledge that Kant was the source of his view that space and time are transcendentally ideal (i.e., mental constructs). Yet surely, the question that was so crucial to young Albert's early reflections on relativity, "Was it possible that the key to understanding the universe was in the structure of our own minds?",[15] must have occurred to him as a direct result of his reading of Kant.

That Einstein was aware of Kant's influence is evident from a letter he wrote to Ernst Cassirer on 5 June 1920, after reading his "treatise" (i.e., Cassirer 1921).[16] Einstein says he thoroughly studied Cassirer's book and is mostly in agreement. The only *disagreement* he cites is that Cassirer too closely identifies Newton and Kant on their views of space and time: "Newton's theory requires an absolute (objective) space in order to be able to attribute real meaning to acceleration, which Kant does not seem to have recognized."[17] To presume to correct such an eminent Kant-scholar, Einstein must have felt confident that he knew Kant's

text well. Ironically, as the editors of Einstein's letters note, Cassirer's book *does* present Kant's theory accurately, as claiming "that absolute space is not to be seen as a real object itself, but as an idea guiding our intellect" [18]—a position close (if not identical) to Einstein's. Clearly, Einstein had not read Cassirer's book with sufficient care; but the point here is that his complaint against Cassirer reveals that Einstein *was* aware of the revolutionary impact of Kant's non-Newtonian view of space and time.

Just ten days after Einstein wrote the above letter to Cassirer, Hans Reichenbach wrote to Einstein requesting permission to dedicate his book, *Relativity Theory and A Priori Knowledge*, to Einstein. In that letter Reichenbach disparages Cassirer and the neo-Kantians, saying "very few tenured philosophers have the faintest idea that your theory is a philosophical feat and that your physical conceptions contain more philosophy than all the multi-volume works by the epigones of the great Kant."[19] He then describes his book as an "attempt to free the profound insights of Kantian philosophy from its contemporary trappings and to combine it with your discoveries within a single system."[20] Cassirer and Reichenbach, therefore, both wanted to render Einstein's relativity theory consistent with Kant's philosophy, though in substantially different ways.[21] Perhaps in the end the main reason Einstein refused to acknowledge the full extent of his debt to Kant was that this enabled him to remain aloof from this (to him) onerous battle between the neo-Kantians and the logical empiricists.

2. Two Perspectives on Science: Synthetic A Priori Principles vs. Heuristic Conventions

Another feature of Einstein's theory of relativity that resonates with Kant's philosophy is its dependence on perspectival reasoning. Contrary to some popular portrayals, Einstein's theory does not imply "relativism", in the sense that term is typically used today, whereby there simply are no absolutes.[22] Rather, Einstein's insights on the simultaneity paradox arose out of thought experiments based on the *perspective* of observers considered in different contexts. One of the cornerstones of the special theory of relativity is the principle that all frames of reference are equivalent with respect to the laws of physics. Where did

Einstein learn to regard different perspectives as equally valid, even if observers adopting those perspectives perceive different results? As I argued in §1 of Part I, perspectival reasoning constitutes the core of Kant's philosophical method.[23] While it is also employed by philosophers such as Leibniz and Spinoza, Einstein did not read these philosophers until much later. So his early exposure to Kant must have been a primary source for this aspect of Einstein's worldview—though of course, he had to apply perspectival reasoning in his own unique way in order to resolve problems in physics.

We can now further contextualize Einstein's reluctance to align himself too closely with Kant[24] by recalling Abraham Pais' opinion that, although "philosophy stretched his personality", Einstein's own "philosophical knowledge played no direct role in his major creative efforts."[25] This depends on what "direct" means. Einstein's reading of Kant at such a young age—Pais himself says it may have begun as young as 10, but was certainly well underway by the time Einstein was 15[26]—is very likely to have had a "direct" influence on the way Einstein thought: at the very least, as we saw in Part I, it provided a grounding for his general "worldview"; and we now know from §1 of this article that it probably also focused his attention on the importance of the simultaneity paradox as well as suggesting the correct method for solving it. However, Einstein's relativity theory is based on an *empirical* absolute that is not present in Kant: in special relativity, this absolute is the constant speed of light; in the later, general theory of relativity, Einstein adopts the notion of a curved (non-Euclidean) spacetime as the absolute framework for all of physics. Obviously, Pais is correct if he means that neither of these ideas came directly from Kant. Nevertheless, they were made possible by the Kantian worldview that had permeated Einstein's thinking since he was a young teenager—a worldview that was suppressed when he was forced to turn away from philosophy and toward science as the focal point of his career and was later *re*pressed when he turned away from Germany and Germany turned away from him during his adult years (see Part I, §4); yet it continued to ground his thinking throughout his life.

That the teenage Einstein had bathed himself in Kant makes it hardly surprising that so many of his contemporaries, as we have seen, emphasized interesting parallels between the

two. In response to one such suggestion put to him during a meeting of the Société française de Philosophie, Einstein replied:[27]

> On the matter of the philosophy of Kant, I believe that every philosopher has his own Kant, and so I cannot reply to what you have just said, because the few indications that you gave are not enough for me to know how you interpret Kant. I do not believe, for my part, that my theory agrees on all points with the thought of Kant such as it appears to me.
>
> What appears to me most important in the philosophy of Kant is that it speaks of *a priori* concepts for constructing science. However, one can oppose two points of view: the apriorism of Kant, in which certain concepts are preexistent in our knowledge, and the conventionalism of Poincaré. These two points of view agree on this point, that in order to be constructed, science has need of arbitrary concepts; as for knowing if these concepts are given *a priori* or are arbitrary conventions, I can say nothing.

Einstein's concluding choice of words seems to beg the question: by saying the concepts necessary to construct science are "arbitrary", he appears to side with Hume, viewing concepts such as causality not as Kantian principles of pure understanding, and space and time not as Kantian pure intuitions, but all such notions as merely heuristic devices (cf. Humean "habits") for interpreting the world. Nevertheless, if we focus on Einstein's appeal to two perspectives (or "points of view") and take "arbitrary" literally, to mean *freely-chosen*, Einstein's point has a markedly Kantian twist after all.

For Kant, our *freedom* from the world makes science possible, freedom being the idea of reason corresponding to the cosmological antinomies. He argued in the Appendix to the Dialectic of the first *Critique* that science must adopt certain ideas of reason as heuristic ("as if") devices to encourage systematic unity. But for Kant, unlike Einstein, the pure intuitions of space and time, together with causality and other principles of pure understanding, have a special status: in order to produce science, we *must* "freely choose"—yes, in this limited, perspectival sense, "arbitrarily"—to intuit the world using the formal structure of space-time

and to conceptualize it using the formal structure of schematized categories such as causality. Kant distinguishes this synthetic a priori "free choice" from the hypothetical free choice of rational ideas that enable us to bring unity into a system of science. The former structures *must* be presupposed by anyone who wishes to obtain scientific knowledge; the latter may be revised as science becomes continually more refined. Along these lines, Fölsing rightly observes that Einstein probably first learned to think in terms of this "heuristic viewpoint" from his early reading of Kant, "who frequently used 'heuristic principles.'"[28] Einstein's heuristic method "was to state, or perhaps invent, an assertion from which familiar facts could then be deduced." As such, "there is a distinctively Kantian flavour in Einstein's position on the nature of scientific knowledge."[29] However, by rejecting synthetic apriority in his casual comments on Kant, Einstein's "free choice" conflates what Kant distinguishes: the (perspectival) necessity of principles such as causality becomes just another heuristic device that scientists may or may not adopt in search of systematic unity.

After briefly summarizing his quasi-Humean epistemology, Einstein explains his major disagreement with Kant:[30]

> Kant ... took ["certain concepts, as for example that of causality"] ... to be the necessary premises of every kind of thinking and differentiated them from concepts of empirical origin. I am convinced, however, that this differentiation is erroneous ... All concepts ... are from the point of view of logic freely chosen conventions, just as is the case with the concept of causality ...

Perspectival interpretations now commonly recognize that Kant did not intend his principle of causality to apply to "every kind of thinking", but only to any thinking destined to produce empirical (especially *scientific*) knowledge. Einstein's use of the perspectival phrase "from the point of view of logic" rests on a fundamental misunderstanding: Kant defends the synthetic apriority of space, time, and the schematized categories not from the *logical* perspective (where the relation between concepts is one's only concern), but from the *transcendental* perspective (where the focus is on concepts joining with intuitions to produce valid judgments). Assessing the origin of concepts from the logical perspective will naturally

produce different results from those produced when adopting the transcendental perspective, as Kant demonstrates in the Dialectic, where he examines proper and improper uses in science of concepts with no grounding in intuition. Kant there defends the same view Einstein later backed, that in the purely *logical* task of system-building, *one's guiding assumptions are heuristic conventions*. By failing to distinguish between the transcendental perspective as it operates in the *Critique's* Aesthetic and Analytic of Principles and the logico-hypothetical perspective as it operates in the Analytic of Concepts and in the Dialectic, Einstein neglects the subtlety of Kant's key perspectival distinctions. The alleged synthetic a priori status of space, time, and causality was *the* issue Einstein associated with Kant; he mentions it virtually every time he criticizes Kant. Ironically, as we shall see in §3, Einstein had a *stronger* (i.e., more absolute) commitment to spatiotemporal causality than Kant himself had.

Einstein openly acknowledges the Kantian grounding of his worldview in his June 1920 letter to Cassirer: "I can understand your idealistic way of thinking about space and time and also believe that one can thereby arrive at a consistent point of view. Not being a philosopher, the philosophical antitheses seem to me more conflicts of emphasis than fundamental contradictions."[31] He goes on to argue that the empiricism of Mach and the Kantian idealism of Cassirer are *both acceptable*, provided they are considered as emphasizing different conceptual perspectives. Unfortunately, Einstein's public statements on Kantian philosophy were often not so open-minded.

A separate study would be needed to establish how Kant's synthetic a priori can be consistent with the notion that such principles are, nevertheless, freely chosen as viewed from the Dialectic's logico-hypothetical perspective. My previous, perspectival interpretation of Kantian apriority clears up various interpretive difficulties often associated with Kant's theory.[32] The same hermeneutic strategy can be applied straightforwardly to Einstein's case: Kant's theory of the synthetic apriority of space, time, and causality, when considered from the philosopher's transcendental perspective, is wholly consistent with a thoroughly (and exclusively) a posteriori theory of the origin of knowledge, considered from the scientist's

empirical perspective. Describing that a posteriori status as a heuristically chosen "convention" poses no challenge to Kant's theory, for as we have seen, Kant himself emphasizes the importance of hypothetical conventions for science. Similarly, Moritz Schlick criticizes Reichenbach for not recognizing that "*a priori* correspondence principles" are "completely identical to Poincaré's 'conventions'".[33] A "Non-positivist" critic likewise criticizes Reichenbach's approach, telling Einstein: "It seems to me…that you have not at all done justice to the really significant philosophical achievement of Kant…. I think your censure [of Kant] is directed less against Kant himself than against those who today still adhere to the errors of 'synthetic judgments *a priori.*'"[34] With such confusingly conflicting statements coming from the philosophical experts of Einstein's day, it is no wonder that he sought to distance himself from both Kant and synthetic apriority. But *did* Einstein, in fact, reject the role of causality as a transcendental principle? A brief examination of this question will serve as a prelude to our discussion of the religious aspects of Einstein's Kantian worldview.

3. The Irony of Einstein's Claim To Have Rejected Synthetic Apriority

Einstein's unwillingness to accept Kant's theory of the synthetic a priori status of the principle of causality ironically led him to adopt a position regarding the status of causality that prevented him from accepting the empirical evidence for quantum indeterminacy. Despite his many references to the "arbitrary" nature of all theoretical concepts in science, in practice Einstein took causality to be more than just a mental construct that the mind *must* impose onto the (mentally constructed) space-time continuum in order for scientific knowledge to be possible—this being Kant's perspectival position. Instead, he treated causality as so *absolute* that he rejected the whole notion of independent free will.[35] In his mature years this bias had such an impact on Einstein's approach to the emerging science of quantum mechanics that he adamantly refused to accept the "arbitrary convention" that most physicists regarded (and still regard) as providing the most plausible account of quantum events: at the lowest level of submicroscopic nature, the concept of causality ceases to be

applicable. Niels Bohr's "Copenhagen interpretation" of quantum physics (that the principle of causality is irrelevant when science deals with objects or events that are *not* observable) is itself thoroughly Kantian.[36] Yet Einstein, failing to grasp (or possibly, understanding but simply choosing to reject) Kant's notion of synthetic apriority, insisted on postulating hidden variables that would explain the "true" (i.e., *causal*) explanation for quantum events—a possibility that has now been experimentally refuted by Bell's Theorem.

A similar irony is that, by rejecting Kantian apriority, Einstein lost a golden opportunity to provide a philosophical justification for the deeply cherished *religious* aspects of his worldview. Kant's transcendental perspective explains *why* the "absolute things" Einstein honored with such reverent awe cannot be spoken about in scientific terms without transforming them into something that is not absolute.[37] In fact, the mature Einstein did applaud Kant for realizing the profound importance of the mysterious yet necessary *comprehensibility* of the world. "It is one of the great realizations of Immanuel Kant", Einstein observes, "that the setting up of a real external world would be senseless" were this mysterious comprehensibility not possible.[38] This relates to what Kant calls the "affinity" of the manifold—a term Kant uses 19 times in the first *Critique*, most notably in the first edition of the Transcendental Deduction (all omitted in the second edition) and in his account of the regulative use of the ideas of reason.[39] It refers to the mysterious, yet necessary "fit" between our faculty of sensibility (producing the "manifold of intuition") and our faculty of understanding (conceptualizing the manifold). Without presupposing such affinity, we might still experience the striking diversity of our perceptions and be able to think consistently in abstraction from experience, but *empirical science* could not exist. This illustrates how both Kant and Einstein based their understanding of science on a two-sided mystery: the *in*comprehensibility of the "absolute things" in their most fundamental, nameless state; and the amazing *comprehensibility* of the world as constructed out of the network of concepts we create to explain the way things appear to be.

One further example should suffice to establish the ironic (almost self-defeating) nature of Einstein's reluctance to admit the Kantian grounding of his worldview. In the

"Reply to Criticisms" that concludes the *festschrift* in his honor, Einstein attempts to distance himself from any particular philosophical position; yet, for anyone familiar with Kant's Critical method, his words only intensify the impression that Einstein was, whether or not he admitted it, applying Kant's philosophical revolution to science:

> Science without epistemology is—insofar as it is thinkable at all—primitive and muddled.... The scientist ... must appear to the systematic epistemologist as a type of unscrupulous opportunist: he appears as *realist* insofar as he seeks to describe a world independent of the acts of perception; as *idealist* insofar as he looks upon the concepts and theories as the free inventions of the human spirit (not logically derivable from what is empirically given); as *positivist* insofar as he considers his concepts and theories justified *only* to the extent to which they furnish a logical representation of relations among sensory experiences.[40]

Einstein's claim, that one can be a realist from one perspective yet an idealist from another, unmistakably mirrors a fundamental tenet of Kant's epistemology, that "[t]he transcendental idealist ... is an empirical realist, and allows to matter, as appearance, a reality which does not permit of being inferred, but is immediately perceived."[41] That Einstein added a nod to his positivist supporters (several of whom started out as quasi-Kantians, though these logical empiricists departed further and further from Kant as they refined their position) only intensifies the sense that he is here revealing, albeit unintentionally, his own Kantian roots.

Perhaps the ultimate irony is that Einstein did *not* unambiguously affirm Kant's perspectival hermeneutic, whereby a person can defend apparently conflicting ideas without destroying the integrity of one's system, provided one is adopting different perspectives wherever the conflicts arise. Recent interpreters of Kant have argued that this is central to the whole Kantian project, that we cannot understand how Kant's specific arguments function if we fail to recognize the perspective Kant adopts when advancing each argument. But none of the contemporary philosophers who were competing for Einstein's attention interpreted Kant this way, so he had good reason to reject the Kant he saw them portraying. The irony is that the scientific theory that made Einstein the twentieth century's most influential scientist

utilized the same perspectival methodology that Kant-scholars nowadays see operating in the writings of young Albert's hero. Perhaps the budding genius understood Kant more accurately than did either the neo-Kantians or the logical empiricists who later competed for the mature Einstein's blessing, to whose philosophical expertise he so readily deferred when interpreting (or refusing to interpret) Kant.

We have now seen that, despite his tendency to downplay Kant's influence, Einstein's worldview exhibits these key Kantian features:[42] (1) the "Copernican" notion that revolutionizing science requires changing the background assumptions, so that what previously constituted an unsolvable problem becomes the expected result of the new assumption; (2) space, time, and the schematized categories (especially causality) determine how we understand the empirical world, but are contributed by the human mind rather than being self-subsisting, absolute "containers" whose nature is inherent within the world itself; (3) science requires regulative guidance by certain rational ideas, freely chosen to contribute systematic unity and coherence to the scientist's theoretical system; and (4) a deep, two-sided respect for the mysterious *un*knowability of the world as it is in itself and the amazing *know*ability of the world as experienced. The latter point leads us directly to our final consideration: the resonance between Kant and Einstein on religious matters.

4. Kant and Einstein on Critical Mysticism

That Einstein regarded science as a primarily *conceptual* discipline, and religion—a rarefied, quasi-mystical form of religion—as primarily *intuitive* is illustrated by his frequently-quoted claim: "Science without religion is lame, religion without science is blind."[43] Kant obviously influenced even this expression of the relation between science and religion. Although he might have forgotten its origin, since he did not cite a source, Einstein's statement paraphrases one of Kant's most well-known maxims: "Thoughts without content are empty, intuitions without concepts are blind."[44] Merely replacing Einstein's "science" with "thoughts" or "concepts" and his "religion" with "content" or "intuitions" renders his statement identical to Kant's, except for the use of "lame" in place of "empty". As a teenager,

Einstein read Kant's maxim in German ("*Gedanken ohne Inhalt sind leer, Anschauungen ohne Begriffe sind blind*"), so his later use of "lame" was simply a loose translation of "*leer*" (literally, "empty" or "void"; figuratively, "hollow", "futile", "vain", or "inane")—"lame" being a synonym that simply relies on a different metaphor.

As is well known, "Einstein himself was…a deeply religious man."[45] Brian, for example, notes that "those who knew" the mature Einstein would not only attest to "his admiration for the ethical and aesthetic aspects of some Christian and Jewish traditions", but also "mention his frequent allusions to a cosmic intelligence."[46] Significantly, biographers agree that young Einstein's reading of Kant came just after his experience of a brief bout of extreme religious fervor, when he temporarily adopted the Jewish traditions his parents had discarded. To speculate that Einstein's early study of Kant may have shaped not only his view of science but also his view of God and religion is therefore not without warrant. No author Einstein read during this period was in a better position than Kant to have such an effect, so similarities between their religious worldviews is unlikely to be coincidental. Let us therefore conclude by examining some resonances between Einstein's view of religion (including its relation to science) and Kant's.

Unlike the average reader of Kant nowadays, Einstein was surely aware that Kant can be interpreted as a friend of mysticism, because the outline of his college class on Kant (see Part I, note 39) featured among its topics "Kant and the mystic". The other topics listed on the outline included Kant's books on *Religion* and *The Conflict of the Faculties* (where the first of three sections deals with theology), "Kant as natural philosopher", "The natural history of the heavens", "Space, Time, Causality" and several other typically Kantian topics.[47] That these lectures included an examination of Kant's relation to mysticism seems less surprising once we recall the influence of Carl du Prel's (1885) mystical interpretation of Kant in the waning years of the nineteenth century.[48] Although we do not know how much Einstein actually learned about Kant's views on religion or the then popular notion that Kant's philosophy promotes a (Critical) form of mysticism that is compatible with science, because he did not complete the requirements for the class, he must at least have seen the

outline, so we may safely assume that young Einstein's Kant was a Kant for whom religion and science were two sides of one philosophical coin—just as they were for the mature Einstein.

The deep absolutes in Einstein's theory of relativity, the constant speed of light and the totality of spacetime as a curved (non-Euclidean) structure, are not objects that human beings can experience. We see things *in* light, because we live at the crossroads between matter and energy. However, we cannot travel at the speed of light, and Einstein's theory makes all scientific knowledge necessarily *relative* to this absolute. The popular science fiction portrayals of Einstein's theory, as implying the possibility of time travel or other oddities, are discounted by Einstein himself, who regarded human travel at the speed of light as a practical impossibility. In one interview, Einstein responds to a question about the implications of his theory by claiming that for a *human* space traveler "with a body and sense organs, at the speed of light his body's mass would become infinitely great."[49] Obviously, if things traveling at the speed of light have *infinite* mass, then Einstein's deep absolute just *is* the whole universe, the whole spacetime continuum[50]—an absolute that Kant, too, regards as lying beyond the reach of human knowledge and experience.

Franquiz discusses at length Einstein's mystical tendencies and how they were moderated by his insistence that they be compatible with a scientific worldview.[51] Einstein was fond of saying he believed in Spinoza's God—though Franquiz argues that his self-assessment in this case was not well-informed.[52] But when we let Einstein speak for himself, his position on religious issues is admittedly very difficult to pin down. In a personal conversation, for example, Einstein once said:

> Try and penetrate with our limited means the secrets of nature and you will find that, behind all the discernible concatenations, there remains something subtle, intangible and inexplicable. Veneration for this force beyond anything that we can comprehend is my religion. To that extent I am, in point of fact, religious.[53]

What we can say is that the "transcendent awe" Einstein experienced when he contemplated the mysterious "order and harmony" science perceives in a world whose absolute nature

remains unknowable[54] is an essential feature of Kant's Critical mysticism.[55] Indeed, one would be hard pressed to say whether Kant or Einstein penned exclamations such as the following: "In the universal silence of nature and in the calm of the senses the immortal spirit's hidden faculty of knowledge speaks an ineffable language and gives [us] undeveloped concepts, which are indeed felt, but do not let themselves be described."[56]

Instead of recognizing the Kantian features in Einstein's veneration of the absolute but unknowable grounding of nature, Jaki reads the Dialectic of the first *Critique* as if it *undermines* the very metaphysical ideas (God, freedom, and immortality) that Kant wished to *promote* (primarily from the practical standpoint).[57] Jaki's portrayal of an opposition between Kant and Einstein on this point could hardly be more mistaken: "Once the notion of the universe was made out to be intrinsically unreliable, Kant could argue that any step from the universe to the Creator was also unreliable. But once the notion of the universe was fully vindicated by general relativity, Kant's argument and his whole criticism of natural theology lost whatever credibility it could marshal."[58] Einstein's theory of relativity is no more a vindication of the concept of the universe than Kant's critique of the concept as a speculative "idea of reason" was a rejection of the great usefulness this idea can have for science, when adopted as a heuristic convention. On this issue Kant and Einstein are of one accord, both seeing the universe as a hypothetical construct, an idea whose reality could never be conclusively proved with empirical (observational) evidence, yet must be assumed in order to guarantee the unity and coherence of empirical science.[59]

Einstein described his theory of relativity not so much as a radical revolution, but more as a natural evolution from a variety of foregoing theorists, beginning with Newton and passing through Faraday, Maxwell, Planck, etc.[60] I have argued that a grounding in an essentially Kantian worldview played a significant and often unrecognized place in that evolutionary process, so that if the young Einstein had not been so "intoxicated" with Kant, he might have never set foot on the path that led him to become the great exponent of a new (yet fundamentally Kantian) way of viewing of the world.[61] Reading Kant was not the *only possible* way Einstein could have been put into this frame of mind, yet this frame of mind

(the worldview) *was* necessary for the discoveries Einstein made. *Somehow* Einstein was led to adopt this worldview, and the previously unnoticed or underemphasized similarities between Kant and Einstein point to his early enthusiasm over Kant as the accident of history that provided this deep-seated grounding. Of course, had Einstein never read Kant, some other influence might have led him to adopt a similar worldview. While Kant did not *teach* Einstein the theory of relativity, reading Kant brought to Einstein's attention both the nature of the problem and the proper philosophical tools and procedure he needed to solve it. As he reflected on the problem of simultaneity, Einstein adopted Kant's challenging new worldview, one that acknowledges the perspectival role of the observer in all knowledge while resisting the temptation to identify such knowledge with the deepest nature of reality. This worldview was a *necessary prerequisite* for Einstein's great revolution in twentieth-century physics.

Footnotes

[1]"The Kantian Grounding of Einstein's Worldview: (I) The Early Influence of Kant's System of Perspectives", *Polish Journal of Philosophy* IV.1 (Spring 2010), ##-##; hereafter abbreviated as "Part I".

[2]Albert Einstein, "Autobiographical Notes", in P.A. Schilpp (ed.), *Albert Einstein: Philosopher-Scientist*[2] (La Salle, Ill.: Open Court, 1949/1969), 53.

[3]Carl Friedrich von Weizsäcker, "Einstein's Importance to Physics, Philosophy and Politics", tr. Dr. and Mrs. M. Skopec in Peter C. Aichelburg and Roman U. Sexl (eds.), *Albert Einstein: His Influence on Physics, Philosophy and Politics* (Braunschweig, Germany: Friedr. Vieweg & Sohn, 1979), 160.

[4]Although there is no conclusive evidence that Einstein was familiar with the Michalson-Morley experiment as a teenager, he explicitly states that he *was* aware of the problem of simultaneity that it created for the physics that was being discussed during Einstein's youth. He also mentions this problem in the first paragraph of the ground-breaking paper that introduced the principle of relativity. See Albert Einstein, "On the Electrodynamics of Moving Bodies", in *Einstein's Miraculous Year: Five Papers That Changed the Face of Physics*, ed. John Stachel (Princeton: Princeton University Press, 1998), 123-160; originally published in *Annalen der Physik* 17 (1905), 891-921.

[5]Ibid., 124.

[6]von Weizsäcker, 161.

[7]Immanuel Kant, *Critique of Pure Reason*, tr. Norman Kemp Smith (London: Macmillan, 1929), 46. References cite the second (1787) edition, except that those prefaced with "A" are unique to the first (1781) edition.

[8]Ibid., 47.

[9]Ibid., 247-49.

[10]For other references to simultaneity, see Ibid., 112, 139, 226, 260, 262, 319-20, and 456.

[11]von Weizsäcker, 161.

[12]Einstein, *Ideas and Opinions*, ed. Carl Seelig (New York: Crown, 1954), 229, 246-47.

[13]Einstein, "Notes", 61.

[14]Albert Einstein, *The Berlin Years: Correspondence, 1914-1918*, tr. Ann M. Hentschel as Volume 8 in *The Collected Papers of Albert Einstein* (Princeton: Princeton University Press, 1998), 165.

[15]Dennis Overbye, *Einstein in Love: A Scientific Romance* (New York: Viking, 2000), 7.

[16]Einstein, *The Berlin Years: Correspondence, May-December 1920, and Supplementary Correspondence, 1909-1920*, tr. Ann M. Hentschel as Volume 10 in Diana Kormos Buchwald, et al. (eds.), *The Collected Papers of Albert Einstein* (Princeton: Princeton University Press, 2006), 44.

[17]Ibid.

[18]Ibid., 294n (German edition). See Ernst Cassirer, *Zur Einsteinschen Relativitätstheorie. Erkenntnistheoretishce Betrachtungen* (Berlin: Bruno Cassirer, 1921), 83.

[19]Einstein, 2006, 57.

[20]Ibid.

[21]Ryckman provides a detailed historical overview of this fascinating period in the history of the philosophy of science. As he and various other historians of science detail (see notes 42 and 47 of Part I), Reichenbach and the logical empiricist school won the battle over how Einstein's theory should be interpreted; but Ryckman argues that Cassirer and others with neo-Kantian leanings deserve a second hearing, as transcendental idealism may be the only plausible way to preserve a robust empirical realism that is consistent with relativity theory. See also note 45 of Part I and Thomas Ryckman, *The Reign of Relativity: Philosophy in Physics 1915-1925* (New York: Oxford University Press, 2005).

[22]For a detailed account of this distinction, see Nathan Rotenstreich, "Relativity and Relativism", in Gerald Holton and Yehuda Elkana (eds.), *Albert Einstein: Historical and Cultural Perspectives* (Princeton: Princeton University Press, 1982), 175-204.

[23]See also my book, *Kant's System of Perspectives: An architectonic interpretation of the*

Critical philosophy (Lanham, MD: University Press of America, 1993), especially Chapter II.

[24]For details on this tendency of Einstein's, and an initial attempt to explain why this does not constitute counter-evidence for the main thesis of this pair of articles, see §4 of Part I.

[25]Abraham Pais, *Einstein Lived Here* (Oxford: Clarendon Press, 1994), 13.

[26]Ibid., 520.

[27]Max Laclerc (ed.), "La Théorie de la Relativité" (transcript of discussion on April 6, 1922), *Bulletin de la Société française de Philosophie* 17 (1922), 91-113; my translation. The partial translation in Pais, *"Subtle is the Lord": The Science and the Life of Albert Einstein* (Oxford: Oxford University Press, 1982), 319, and in Pais, 1994, 213-14, is misleadingly loose; he also cites incorrect volume and page numbers for the journal. As the original is rare and difficult to trace, I provide the French here in its entirety:

> A propos de la philosophie de Kant, je crois que chaque philosophe a son Kant propre, et je ne puis répondre à ce que vous venez de dire, parce que les quelques indications que vous avez données ne me suffisent pas pour savoir comment vous interprétez Kant. Je ne crois pas, pour ma part, que ma théorie concorde sur tous les points avec la pensée de Kant telle qu'elle m'apparaît.
>
> Ce qui me paraît le plus important dans la philosophie de Kant, c'est qu'on y parle de concepts *a priori* pour édifier la science. Or, on peut opposer deux points de vue: l'apriorisme de Kant, dans lequel certains concepts préexistent dans notre conscience, et le conventionalisme de Poincaré. Ces deux points de vue s'accordent sur ce point que la science a besoin, pour être édifiée, de concepts arbitraires; quant à savoir si ces concepts sont donnés *a priori*, ou sont des conventions arbitraires, je ne puis rien dire.

[28]Albrecht Fölsing, *Albert Einstein: A Biography*, tr. Ewald Osers (New York: Viking, 1997), 136.

[29]Friedel Weinert, "Einstein and Kant," *Philosophy* 80 (2005), 591.

[30]Einstein, "Notes", 13.

[31]Einstein, 2006, 44.

[32]See Stephen Palmquist, "A Priori Knowledge in Perspective: (I) Mathematics, Method and Pure Intuition", *The Review of Metaphysics* 41:1 (September 1987), 3-22; and "A Priori Knowledge in Perspective: (II) Naming, Necessity and the Analytic A Posteriori", *The Review of Metaphysics* 41:2 (December), 255-82. For a recent study of how Kant's theory of synthetic apriority provided a backdrop for relativity theory, see Robert DiSalle, *Understanding Space-Time: The Philosophical Development of Physics from Newton to Einstein* (Cambridge: Cambridge University Press, 2006), Chapter 3 ("Empiricism and a priorism from Kant to Poincaré"). DiSalle notes that Kant did defend the need for a concept of absolute space in physics, but correctly points out that this was a matter for empirical realism to decide, not part of what is required by Kant's transcendental idealism (67).

[33]Letter to Einstein, dated 9 October 1920, in Einstein, 2006, 171.

[34]Einstein, "Reply to Criticisms: Remarks to the Essays Appearing in this Collective Volume", in Schilpp, 678-79.

[35]For example, Einstein 1954, 8-9, says: "I do not at all believe in human freedom in the philosophical sense. Everybody acts not only under external compulsion but also in accordance with inner necessity.… This realization mercifully mitigates the easily paralyzing sense of responsibility and prevents us from taking ourselves and other people all too seriously; it is conducive to a view of life which, in particular, gives humor its due."

[36]See for example, Mara Beller, *Quantum Dialogue* (Chicago: University of Chicago Press, 1999), 162, 180, 205. For a detailed defense of the Kantian grounding of quantum mechanics, see my paper, "Quantum Causality and Kantian Quarks" (under review).

[37]See the first paragraph of Part I, and my book, *Kant's Critical Religion: Volume Two of Kant's System of Perspectives* (Aldershot: Ashgate, 2000).

[38]Einstein, "Physics and Reality" (1936), reprinted in Einstein's *Essays in Physics* (New York: Philosophical Library, 1950), §1. Max Jammer, *Einstein and Religion: Physics and*

Theology (Princeton: Princeton University Press, 1999), 42, lists references substantiating Einstein's claim.

[39]E.g., Kant, 689-91.

[40]Einstein, "Reply", 684.

[41]Kant, A371; see also A375. I discuss this passage in *Kant's System*, 175n.

[42]For an excellent distillation of "Einstein's philosophy" into seven basic ideas (all of them consistent with the Kantian position defended here), see Pais, 1994, 130-2.

[43]This statement (quoted, for example, in Pais, 1982, vi, and 319; Jammer, 11) is from Einstein, *Nature* 146 (1941), 605.

[44]Kant, 75.

[45]Pais, 1982, 319.

[46]Denis Brian, *Einstein: A Life* (New York: John Wiley & Sons, 1996), 4-5.

[47]Einstein, 1987, 364 (German edition). For a thorough account of the likely contents of this college class, taught by August Stadler, see Mara Beller, "Kant's Impact on Einstein's Thought", in Don Howard and John Stachel (eds.), *Einstein: The Formative Years, 1879-1909* (Boston: Birkhäuser, 2000), Chapter 4.

[48]Carl du Prel, *Die Philosophie der Mystik* (1885), tr. C.C. Massey as *The Philosophy of Mysticism*, 2 vols. (London: George Redway, 1889). For a thoroughgoing study of Kant's relation to mysticism, see my book, *Kant's Critical Religion*, Chapters II and X-XII.

[49]Brian, 115.

[50]Cf. Einstein, 1954, 247-8.

[51]J.A. Franquiz, "Albert Einstein's Philosophy of Religion", *Journal for the Scientific Study of Religion* 4.1 (Autumn 1964), 64-70.

[52]Ibid., 67. Franquiz claims that Einstein's beliefs were closer to those of an "intelligent Christian Theism" than Spinozian pantheism. The compatibility between this way of interpreting Einstein and my portrayal of Kant in Part Four of *Kant's Critical Religion* should be obvious to readers familiar with the latter. Beller affirms such compatibility: "There is no

doubt that there is a close affinity between the Einsteinian and the Kantian God. The Einsteinian God is the God of Kant, and not of Spinoza, as often stated (sometimes by Einstein himself)" (Beller, 2000, 94).

[53]Jammer, 39-40.

[54]Roy D. Morrison, "Einstein on Kant, Religion, Science, and Methodological Unity", in Dennis P. Ryan (ed.), *Einstein and the Humanities* (New York: Greenwood Press, 1987), 54.

[55]See *Kant's Critical Religion*, Part Four.

[56]Kant, *Allgemeine Naturgeschichte und Theorie des Himmels oder Versuch von der Verfassung und dem mechanischen Ursprunge des ganzen Weltgebäudes, nach Newtonischen Grundsätzen abgehandelt* (1755), Vol. 1 in *Kants gesammelte Schriften* (Berlin: Walter de Gruyter, 1902-), 367; translation mine.

[57]Stanley L. Jaki, "The Absolute Beneath the Relative: Reflections on Einstein's Theories", in Dennis P. Ryan (ed.), *Einstein and the Humanities* (New York: Greenwood Press, 1987), 5-18.

[58]Ibid., 12-13.

[59]See my article, "Kant's Cosmogony Re-Evaluated", *Studies in History and Philosophy of Science* 18:3 (September 1987), 255-69, for a detailed critique of Jaki's appallingly premature and simplistic rejection of Kant.

[60]Einstein, 1954, 248, 227-32. See also Jammer, 35.

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