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The Kantian Grounding of Einstein's Worldview: (I) The Early Influence of Kant's System of Perspectives

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Abstract

Recent perspectival interpretations of Kant suggest a way of relating his epistemology to empirical science that makes it plausible to regard Einstein's theory of relativity as having a Kantian grounding. This first of two articles exploring this topic focuses on how the foregoing hypothesis accounts for various resonances between Kant's philosophy and Einstein's science. The great attention young Einstein paid to Kant in his early intellectual development demonstrates the plausibility of this hypothesis, while certain features of Einstein's cultural-political context account for his reluctance to acknowledge Kant's influence, even though contemporary philosophers who regarded themselves as Kantians urged him to do so. The sequel argues that this Kantian grounding probably had a formative influence not only on Einstein's discovery of the theory of relativity and his view of the nature of science, but also on his quasi-mystical, religious disposition.

1. Kant's System of Perspectives as the Grounding for Modern Scientific Revolutions

In the course of defending Albert Einstein's revolutionary approach to physics, and perhaps also as an implicit affirmation of Einstein's religious worldview, Sir Arthur Eddington boldly asserted: "There are absolute things in the world but you must look deeply for them."[1] What are these "absolute things", in terms of Einstein's theory of relativity? Are they explicable or necessarily mysterious? Moreover, what led young Einstein to his revolutionary convictions regarding this deep absolutes that govern the natural world? The suggestion that Einstein's worldview was essentially Kantian might seem unwarranted for two reasons. First, Kant is often regarded more as an enemy of metaphysical belief in "deep absolutes" and quasi-religious appeals to mystery (whether physical or theological) than as a philosopher who might engender such convictions. Second, Einstein himself tended to downplay Kant's relevance to his own thinking; if some of the deepest convictions informing his worldview appear to be grounded in Kant's philosophy, we must therefore explain why Einstein did not adequately acknowledge this resonance.

Despite these initial misgivings, I shall argue in this first of two essays on this topic that Einstein's early reading of Kant's philosophy, though often overlooked or trivialized, provides a likely explanation for Einstein's adoption of the worldview (as epitomized by Eddington's statement) that enabled him to discover the theory of relativity. Kant's philosophy, with its "Critical" method,[2] establishes a worldview whereby religion and science can coexist. What I have elsewhere called his "Critical mysticism"[3] is only quasi-mystical, inasmuch as the qualification "Critical" requires anything we say about the mystery of the unknown (the "thing in itself") to be constrained and circumscribed by what is known. If we take into account the delicate balance between the knowable and unknowable in Kant's philosophy, we may find that the modern revolutions in science that challenge the classical theories (especially to Euclidean geometry and Newtonian physics) are each *rooted in* Kant's philosophy. With this possibility in mind, I shall examine various resonances between Kant and Einstein, the first and foremost being that both acknowledge a basic mystery underlying nature yet clearly distinguish between the scientific disposition that employs language to construct empirical knowledge of nature (this being the focus of the present article) and the religious disposition that contemplates and appreciates this mystery as it is in itself (an issue addressed in Part II [see note 79, below]). Although they employ different terms, both Kant and Einstein acknowledge that the constructs of language cannot adequately express the deep absolutes that ultimately ground both scientific knowledge and religious experience.

Kant introduces his revolutionary "Copernican" Perspective in the second edition Preface to the first *Critique*, where he argues that "we can know *a priori* of things only what we ourselves put into them."[4] (When using "Perspective" to refer to the way of thinking that governs Kant's entire philosophical System, I capitalize the "P". This distinguishes it from the four perspectives [small "p"]—the transcendental, logical, empirical, and hypothetical—that operate *within* his three Critical systems.[5]) To illustrate this, he refers to the "intellectual [*Denkart*] revolution" in mathematics, to the "revolution in its point of view [*Denkart*]" in physics, and to the "new method of thought [*Denkungsart*]" in his own philosophical system.[6] Such passages reveal Kant's awareness of the deep methodological connection between scientific and philosophical revolutions. Although in the ordinary world of everyday experience our knowledge must conform to the objects that present themselves to us, we can properly answer philosophical (especially *epistemological*) questions about that world only by making the opposite (Copernican or "Transcendental") assumption: to understand the philosophical foundations of knowledge, we must assume that the objects of knowledge conform to (i.e., are themselves shaped by) the mental powers of the knowing subject. Kant defends this hypothesis with numerous arguments. As with all perspectival revolutions, the best proof is how effectively it helps us solve philosophical, scientific, and religious problems; the more insights a paradigm shift provides for philosophy, science, and religion, the more we can trust its adequacy and regard it as a reliable starting-point for empirical understanding in general (i.e., the more effectively it functions as a "worldview").

My hypothesis is that the scientific revolutions since Kant's day, far from *disproving* the legitimacy of Kant's epistemology and philosophy of science (as commentators so often assume), can be interpreted as *applications* of his philosophical worldview to geometry, arithmetic, logic, physics, quantum mechanics, cosmology, biology, psychology, medicine, etc.[7] The most obvious objection to this hypothesis is that Kant presupposes the legitimacy of an entirely classical worldview, supported by Euclidean geometry, Aristotelian logic, and Newtonian physics. Commentators typically assume Kant had a naive trust in the absolute validity of these (then virtually unchallenged) scientific theories—a trust that has been proved wrong many times over (so the objector assumes) by the radical revolutions in these and other sciences since Kant's day. Miller is typical of those who think Kant's portrayal of space and time as pure intuitions simply "elevated Newton's notions of absolute space and time" to a new level of certainty; he does not realize that in so doing, Kant also effected a radical revolution in how we conceive of space and time themselves.[8]

This standard interpretation can hardly be the whole story, because Kant himself challenges each classical scientific theory in several respects, even though he accepts that each had produced undeniably significant empirical results. His goal is not to justify each theory because it *and no alternative* must be deemed forever correct, but to explain how such impressive results could be attained by *any* scientific theory. If Kant's philosophical account of the nature of scientific knowledge correctly grounded the sciences of *his* day, then it will be just as correct for the sciences of *our* day—the latter being subject to revision just as the classical theories were. Moreover, Kant's reference to several past scientific revolutions in the first *Critique's* second Preface suggests that he expected the new grounding provided by his Copernican revolution in philosophy to have a reforming effect on the exact sciences.

For our present concerns the most important example is that, although Kant accepts the basic tenets of Newton's laws of physics as empirically established principles, he rejects as untenable the philosophical worldview Newton assumes as its background: that space has an absolute, self-sufficient reality that we can distinguish both from ourselves and from the reality of an equally absolute time. In direct opposition to this philosophical position, called "transcendental realism", Kant defends a two-sided theory called both "transcendental idealism" and "empirical realism". According to Kant, both space and time must be viewed, from the transcendental perspective, as "forms of intuition" that our mind imposes onto the world. All objects of human knowledge must present themselves in spatio-temporal form, he argues, because viewed from the transcendental perspective, we impose this form onto empirical objects.[9] The transcendental conditions are precisely what enable us observers to regard objects in space and time as independently real from the empirical perspective.

This drastic revision of the Newtonian worldview, of his *philosophy* of space and time as absolute "containers" for objects of knowledge, paved the way for many of the great scientific revolutions we have witnessed during the past two centuries. For Kant's new background theory leads to a result never contemplated by Newton: if we regard them as they are *in themselves*, the objects we must perceive as being *in* a certain kind of time and space are *released* from transcendental necessities such as Euclidean geometry; constructing a geometry of space or a physical (mechanistic) theory of spatial objects that is not bound by the perceptual limitations we impose onto our observations then becomes a contingent matter, the discovery of whose exact nature is the scientist's never-ending task.[10] In the remainder of this article I shall demonstrate that Einstein knew about Kant's revolutionary philosophy and argue that it provided just such a transcendental grounding for his revolutionary scientific theories.

2. The Controversial Resonance between Kant and Einstein

That Kant-scholars themselves often overlook the grounding Kant's philosophy provided for modern scientific revolutions, perhaps because Kant did not explicitly predict the profound impact his paradigm shift in philosophy would have on empirical science, partially explains why commentators on *Einstein* also tend to neglect the Kantian grounding of his worldview. For instance, one popularizer of modern physics, oblivious to any resonance between Einstein and Kant, naively claims: "It took an Einstein to make scientists *and philosophers* realize that geometry is not inherent in nature, but is imposed upon it by the mind."[11] Weinert acknowledges the resonance, but overlooks the subtlety of Kant's view of geometry when he writes: "Einstein is a Kantian in the outlines of his philosophy, but not in the details of his physics".[12] Of course, Kant did not *foresee* relativity physics; but the latter is not inconsistent with Kant's philosophical grounding for science. By defending a new worldview, bearing striking resemblances to the one Einstein adopts, Kant prepared the way for the non-Euclidean geometries that were already well developed by Einstein's youth.[13]

Ilse Schneider, a philosophy student fortunate enough to travel with Einstein on numerous train trips to and from university, was working at the time on "the relation of [Einstein's] theories to philosophy and, in particular, to the philosophy of Kant." She refers to the typical claim "that Einstein's theories had 'refuted' Newton's and that therefore Kant's ideas of space and time were refuted too" as being a grossly "superficial judgement".[14] She frequently discussed with Einstein "Spinoza's metaphysics…as well as the epistemology of Hume or Kant". In one such discussion, "concerning Kant's views on the general universal laws of nature in their relation to geometry—which, by the way, are very similar to Einstein's",[15] he reportedly offered the following, humorous metaphor:

> "Kant is a sort of highway with lots and lots of milestones. Then all the little dogs turn up and each deposits its contribution at the milestones." Pretending to feel indignation I said: "But, what a comparison!" With his loud, boyish laughter, he remarked: "But what will you have? Your Kant is the highway after all, and that is there to stay."[16]

After finishing her dissertation, Schneider published it in 1921 as *Das Zaum-Zeit-Problem bei Kant und Einstein*—an interpretation Einstein once referred to as the "relativized Kant".[17] In contrast to Schneider's opinion, Einstein once said: "I do not think my [relativity] theory accords with the thought of Kant, that is, with what that thought appears to me to be."[18] The sole evidence he cites when making such comments is that "Kant's apriorism" and "Poincare's conventionalism" are "opposite points of view".[19] As I shall argue in §2 of Part II, however, these two views of science need not be contradictory, inasmuch as Kant's philosophy makes room for both, applied in different ways.

Kant argues that Euclidean geometry's necessary and universal character derives not from any empirical connection between objects but from the subjective constitution of our perceptual capacity. This is compatible with Einstein's view of geometry: both distinguish between the *geometry that can be described* (or pictured)—in its purest form, Euclidean geometry—and the actual (yet ultimately imperceptible) geometry underlying the empirical world. Kant insists that the latter (probably one of Eddington's "absolutes"), insofar as we regard the world as a thing in itself, is unknowable; Einstein is equally insistent that the scientist's theories about this world—geometrical and otherwise—remain hypothetical and ultimately approximate. Einstein therefore confirms Kant's basic insight, that insofar as science is to be *necessary and universal*, it must be grounded in transcendental principles, whereas once it becomes genuinely empirical, it loses this quality and becomes tentative and ever-changing.

Einstein focused on the empirical side of this equation because, as von Weizsäcker plainly declares, "Einstein was a physicist and not a philosopher."[20] He later adds: "Neither does he show contempt for philosophy; philosophical questioning is essential to him."[21] Thus, in a letter to Kant-scholar Hans Vaihinger, dated 3 May 1919, Einstein politely refuses Vaihinger's offer to publish a paper of Einstein's in *Kant-Studien*, saying: "I am too little versed in philosophy to take an active part in it myself; if I can be passively receptive to the work of the men in this field, I am content enough."[22] He says his only "service to philosophy" is "to pass on information…about matters regarding my specialty". Such comments demonstrate that Einstein was open to being influenced by philosophers such as Kant yet did not see himself as having philosophical expertise.

Einstein's friend, Abraham Pais, detected a more nuanced attitude toward philosophy and science: "it would be more fitting to call Einstein a natural philosopher than a scientist."[23] While he admits Einstein even "at his best" was not "a philosopher in the academic sense of the term" and that "he did not consider himself a philosopher," Pais emphasizes "that his impact on philosophy was profound."[24] Ignoring Einstein's self-confessed openness to philosophy, Pais boldly proclaims: "It is also certain that his best work was not influenced by any conventional philosophical system."[25] As we shall see in §§2-3 of Part II, Einstein did reject Kant's claim that transcendental principles such as causality are synthetic a priori, perhaps in part because his expertise as a physicist led him, quite rightly, to adopt a bias toward the empirical. I shall argue, however, that what Einstein rejects is not synthetic apriority as such, but the *relevance* of applying this transcendental perspective to scientific observation—a point that does not contradict a perspectival interpretation of Kant. A Kantian can agree with Einstein's comparison of "Kant's celebrated view of time" to "Anderson's fairy tale of the emperor's new clothes",[26] for however meaningful synthetic apriority may be *for transcendental philosophers*, it does not enter, as such, into the empirical process of scientific research. Kant affirms essentially the same view of the exclusively philosophical relevance of synthetic apriority.[27]

In arguing that Einstein was *not* significantly influenced by Kant, Morisson lists six key points of contact between them. Ironically, on the first three points, Morisson admits that Einstein fully agrees with Kant's underlying assumptions about science:

> (1) Einstein retains from Kant the indispensability of the distinction between objective and subjective reality. (2) He shares the notion that all knowledge depends upon and is limited by experience. (3) Like Kant, Einstein employs…[a procedure that] contains features of rationalism and of extreme empirical orientation.[28]

Morrison's fourth point is that, while accepting the relevance of Kant's transcendental principles (e.g., causality), Einstein (following various contemporary philosophers) treats these "as free inventions of the scientific imagination".[29] We shall see in Part II (§2) that this is a direct application *for science* of Kant's theory of the regulative employment of the ideas of reason and does not require (as Einstein admittedly believed) the abandonment of the a priori *for philosophy*. Fifth, like Kant, Einstein had a variety of "moral, theological, and epistemic expectations", but was "less ambitious" than Kant concerning these[30]—as we would expect for someone who was, at best, an amateur philosopher. Finally, Einstein rejected Kant's phenomenal/noumenal distinction, especially his belief that "noumenal causality" gives human freedom a means of influencing the empirical world.[31]

While Morrison's summary correctly highlights two areas of disagreement between Kant and Einstein (the status of transcendental principles and the compatibility of freedom with science), he inadvertently confirms the claim I am defending in this pair of articles, that Einstein's worldview had an essentially Kantian grounding. By relating my argument primarily to Einstein's *worldview* (i.e., to the set of background assumptions that guide one's thinking on almost everything), I am not claiming that Kant had a direct influence on the development of Einstein's specific *scientific* discoveries. That he may have had some minimal influence is a possibility we shall consider in §1 of Part II. What we have established up to now is only that certain key features of Kant's worldview seem to have informed Einstein's background assumptions, even though Einstein was not fully aware of this resonance—a paradox that calls for some resolution. With the foregoing resonances in mind, I shall focus in the remainder of this article on Einstein's intellectual development, in search of evidence that the striking similarity between his worldview and Kant's is more than just coincidental.

3. Kant's Influence on Einstein's Early Intellectual Development

Einstein once recalled the "wonder" he "experienced as a child of 4 or 5 years, when my father showed me a compass.... Something deeply hidden had to be behind things."[32] This intuitive awareness of an obscure "something" that is revealed in our experience of symmetries in nature, yet without allowing itself to be expressed in language, is akin to Kant's "thing in itself".[33] For Kant, the thing in itself is a conceptual construct referring to the natural world, with all the conditions that allow us to conceptualize or describe what we experience abstracted from it. This mysterious reality that must underlie the natural world, if we are to escape Berkeleyan idealism, serves as a paradoxical grounding for the fundamental assumption of Kant's worldview, the "Copernican" Perspective that generates his new methodology for understanding how scientific knowledge arises, through the structuring "compass-points" of the categories—these being the forms we must use to understand the symmetries we experience (see note 33).

In light of his childhood experience of the universe's "deeply hidden" forces, young Albert must have been intrigued by this theory of the thing in itself, the necessarily hidden (i.e., unknowable) absolute underlying our understanding of nature, when he first read Kant's *Critique of Pure Reason*. This momentous event occurred at a surprisingly early stage of Einstein's intellectual development. Max Talmey, a medical student who first met Albert (then age ten) in the Fall of 1889 and had lunch at Einstein's home every Thursday over the next five years,[34] recalls: "I recommended to [young Albert] the reading of Kant. At that time he was still a child, only thirteen years old, yet Kant's works, incomprehensible to ordinary mortals, seemed clear to him."[35] Talmey goes on to claim that "Kant became Albert's favorite philosopher after he had read through his *Critique of Pure Reason*."[36] Einstein's interest in this "boyhood hero"[37] was not short-lived, for Seelig reports that as a "16-year-old youth [Einstein] intoxicated himself with Kant's *Critique of Pure Reason*."[38] Einstein's interest in Kant lasted at least until his early college days: the transcript for his studies at Zurich Polytechnic (Eidgenössische Technische Hochschule, or "ETH") shows that he registered for Prof. August Stadler's class, entitled "Die Philosophie I. Kants", as one of three "Nonobligatory subjects" during the second semester of his first year.[39] The transcript specifies no grade for the Kant subject, so (like most of the classes he registered for) he appears not to have completed the requirements.

Max Jammer, adopting the now commonly accepted view that Kant had no significant, lasting influence on Einstein's intellectual development, cites some of the foregoing testimonies, but warns: "if correct at all," the claim that Kant influenced Einstein "could have referred only to the young Einstein."[40] Jammer observes that the mature Einstein, whenever he waxed philosophical, portrayed himself as rejecting certain central theses in Kant's epistemology, including (most importantly) the synthetic a priori status of the categories. Nevertheless, I shall argue in Part II (§3) that Einstein's rejection was primarily a response to mistaken interpretations of Kant being adopted by contemporary philosophers. Einstein disapproved of positivism, especially in his later years, calling the logical empiricists his "opponents",[41] even though they had been among the most outspoken proponents of his scientific breakthroughs. Both the logical empiricists and the neo-Kantians, who were their chief rivals for Einstein's approval, believed that Kant could provide a philosophical grounding for relativity physics only after being cleansed of his over-confidence in the necessary validity of the synthetic a priori forms of knowledge.[42] When he downplays Kant's influence and emphasizes that of other past philosophers, we should therefore take the mature Einstein to be rejecting the "corrupted" Kant of contemporary *interpreters*, rather than his own private (youthful) interpretation of Kant's philosophy as such.

Michael Friedman offers a detailed account of how Kant, perhaps as much as (if not more than) empiricists such as Mach or Russell, influenced the development of positivism in the first quarter of the twentieth century and how these early positivists (most of whom acknowledged a debt to Kant), in turn, influenced Einstein.[43] Interestingly, the Marburg neo-Kantian, Ernst Cassirer, was also convinced that Einstein's position was not so much a refutation of Kant's transcendental philosophy as a refinement of it. His book[44] is a sustained attempt to present the theory of relativity in a Kantian guise: Einstein *corrects* our understanding of how the synthetic a priori forms (especially space, time and causality) should be applied to physical space, but does not refute the theory. Friedman gives an extended account of the relationship between Cassirer and the positivists,[45] and Weinert[46] lists publications by several others in the early 1920s who argued that Einstein's principles were consistent with Kant's. For these physicists: "The Special theory seemed to confirm what Kant had claimed: that time was a feature of the human mind…. Correct the Kantian view for relativistic effects, and Kant becomes vindicated by the Einsteinian revolution."[47]

The mature Einstein named Spinoza as his favorite philosopher, once replying to the question "Who are your favorite philosophers?" by saying: "I enjoy reading the works of Schopenhauer and Kant and Plato. But my favorite of all is Spinoza."[48] This was certainly not always true of Einstein, if we are to believe Talmey's above-quoted report that at age 13 "Kant became Albert's favorite philosopher."[49] As an adult, Einstein often expressed an explicit preference for Hume over Kant.[50] In a 1915 letter to Moritz Schlick, Einstein says he studied Hume's *Treatise of Human Nature* "avidly and with admiration shortly before discovering the theory of relativity."[51] (The editors date this reading of Hume to 1902.[52]) Having just referred to "Kant and his successors", along with Mach, Hume, and the neo-positivists, Einstein admits: "It is very possible that without these philosophical studies I would not have arrived at the solution."[53] He does not say which of Hume's ideas influenced him or to what extent. Hume's special role, therefore, might have had more to do with the *timing* of Einstein's reading of the arch-skeptic's work than with the closeness of Hume's theories to his own.

Complementing these other influences, Einstein continued reading and discussing

Kant's writings throughout his adulthood. For example, while living in Prague for 17 months in 1911-12, he joined "a group of young Jewish intellectuals [who] gathered weekly to discuss philosophy," sometimes referred to "as '*Kant Abende* [Kant evenings],' because Kant's work was one of the main continuing subjects of discussion."[54] Einstein joined the group just as it was "embarking on a two-year study of Kant's *Prolegomena* and the *Critique of Pure Reason*".[55] Einstein obviously would have known in advance that this was the planned topic, so he must have had an ongoing interest in Kant even at this point. A few years later, in June of 1918, he wrote in a letter to Max Born that he had recently been "lying on the shore like a crocodile", ignoring "the so-called world", and reading books such as "Kant's *Prolegomena*".[56] (By this time Einstein was probably also acquainted with Kant's minor essays relating to various topics in physics and other sciences, because "[a] copy of Buek's [1909] edition of Kant's writings on natural philosophy is in Einstein's library."[57]) Einstein says reading *Prolegomena* enabled him "to understand the enormous impact that has emanated and still is emanating from this fellow."[58] Offering Born his usual gloss on Kant, Einstein confesses his need to "tone down 'a priori' into 'conventional' in order not to have to contradict myself".[59] Although it was tempting to be "ensnared" by Kant, because his philosophy "is very nice reading," it is still "not *as* fine as his predecessor Hume, who also had considerably more common sense."[60] The latter claim is impossible to assess without knowing what Einstein meant by "common sense". It likely indicates that Einstein thought Hume led a more interesting life than Kant—a fact that has nothing to do with the veracity of their respective philosophical theories, nor with the question of which theory provides a more reliable grounding for the subsequent developments of empirical science. However, it does raise a crucial question that calls for an answer before we proceed any further: if Einstein's worldview really is grounded in Kant's philosophy, why was Einstein so reluctant to admit this influence and acknowledge the resonances that others have so clearly seen?

4. Einstein's Reluctance to Acknowledge Kant's Influence

Einstein's tendency to downplay Kant's influence in favor of Spinoza and other non-

German philosophers may be due as much (if not more) to personal factors as to his own reflections on Kant's philosophy. The Kant who so attracted young Einstein, as a German citizen during the heyday of that country's pre-war idealism, would have become considerably less attractive the more disgusted Einstein grew with the German political scene. At age 15, having stayed in a Munich boarding school when his parents and sister moved to Milan in 1894, Einstein gave up his German citizenship (effective January 1896) to avoid fulfilling his otherwise mandatory military service, remaining stateless until he obtained Swiss citizenship five years later.[61] During his time alone in Munich, Einstein "immersed himself in the study of the philosopher, Immanuel Kant."[62] Having already read Kant's *Universal Natural History and Theory of the Heavens* (1755), Einstein "spent the most time on…*Critique of Pure Reason*."[63] Given Kant's innovative suggestions in the former book about the formation of the solar system, the nature of galaxies, and other speculations that later turned out to be confirmed by empirical evidence, and in light of the revolutionary Copernican hypothesis Kant proposes in the latter book, "it's obvious that [Einstein] was already thinking seriously about" issues that later led him to propose "his theory of special relativity".[64] When he arranged to join his parents in Milan six months later, "Einstein had become fascinated by philosophy after reading Kant", so much that "[h]e told his father he would like to teach philosophy"![65] Fortunately for the world of physics, "his practical-minded father" strongly disapproved of such a plan, pointing young Albert in the direction of engineering instead.[66] For the next decade, after all at once giving up his home country, his love of Kant, and his dream of teaching philosophy, Einstein lived in obscurity, first as a university student and high school mathematics teacher, then (starting in 1902) as an employee of the Swiss patent office in Bern.

After publishing five ground-breaking papers in 1905, Einstein skyrocketed to fame. His "sudden worldwide fame was unparalleled, especially for a physicist or mathematician…. From 1919 on he was without question the world's most famous and celebrated scientist, the most loved and the most hated."[67] Less than a decade after the publication of those five papers, in the political turmoil building up to World War I, 93 German academics signed a

"Manifesto to the cultural world" (published on 4 October 1914) praising Goethe, Beethoven and *Kant* as key figures confirming Germany's cultural supremacy.[68] Einstein (now a Swiss citizen) was probably not even asked to sign;[69] as an open opponent of the war, he signed a less publicized "countermanifesto" entitled "Appeal to Europeans".[70] As Einstein's pacifism became more public and Germany's tendency toward anti-Semitism increased, he "became the target of anti-Semitic Germans exasperated by his worldwide fame"; for example, the renowned physicist, Philipp Lenard, claimed "the Jew…lacks understanding for the truth… Science, like every other human product, is racial and conditioned by blood."[71]

By "the 1920s and early 30s", both Einstein and his theories were widely rejected by German academia as "the work of 'Jewish science'."[72] By contrast, Spinoza was Jewish and, like Einstein, experienced political persecution—though Spinoza's was at the hands of his fellow Jews, not an expression of anti-Semitism. Similarly noting the common Jewishness of Spinoza and Einstein, von Weizsäcker reports Einstein "never forgave Germany for" engaging in "the personal attacks" against him.[73] In a context where some German colleagues and students would "greet him with obscenities", send death threats, and even "offered a reward to anyone who killed Einstein the pacifist",[74] we should not be surprised that the mature Einstein was reluctant to admit how deeply his worldview was grounded in the ideas of a German philosopher, Kant.

In his old age, Einstein refused to admit *any* influence from Kant, though he acknowledged that his autobiography, being a work written from the perspective of old age, might not accurately reflect how his experiences seemed when they unfolded.[75] (When he says Hume's philosophy highlights the perspectival/relativistic nature of space better than Kant's,[76] his memory seems to have been as imprecise as his interpretations of Hume and Kant on that issue. Or, Einstein might have had in mind his conviction that geometry must have "an analytical foundation"[77]—a view he did share with Hume but not with Kant.) In a 1949 reply to his critics, with the end of World War II fresh in everyone's memory, he writes:

> I did not grow up in the Kantian tradition, but came to understand the truly valuable [insight] which is to be found in his doctrine, alongside of errors which today are

> quite obvious, only quite late. It is contained in the sentence: "The real is not given to us, but put to us (*aufgegeben*) (by way of a riddle)." This obviously means: There is such a thing as a conceptual construction for the grasping of the inter-personal, the authority of which lies purely in its validation. This conceptual construction refers precisely to the "real" (by definition), and every further question concerning the "nature of the real" appears empty.[78]

For Einstein, "the Kantian tradition" was a complex debate between the Marburg *neo*-Kantianism of Cassirer and the logical empiricism of Schlick, Reichenbach, etc. (see notes 42 and 47, above); *this* is the Kant he came to know only during his adult life; the insight that carries with it an appeal to Kant's "obvious" errors refers to the need both parties in this debate saw to revise Kant's strict position on the synthetic a priori. What remains "valuable", even after correcting the "error", is Kant's awareness that science must rely on subjectively constructed concepts that define what counts as real. The quoted paragraph might seem like a negative comment about Kant, but it is actually quite affirmative, being one of the few places where the mature Einstein openly acknowledges that his own "conventionalism" had its roots in Kant—a point we shall elaborate in §2 of Part II.

Having demonstrated that a Kantian grounding for Einstein's worldview is plausible, given that he fully immersed himself in Kant's philosophy at a young age, and having offered a possible explanation for Einstein's reluctance to admit this grounding, the chief remaining task is to examine more closely the key issue of why Einstein rejected Kant's position on the status of synthetic a priori principles in science. This will be the main focus of Part II in this series of articles.[79] It will, in turn, prepare us to examine the deep resonances between Kant's and Einstein's approach to religion, as a quasi-mystical expression of the absolute mystery of the universe. For together with science, the nature of one's religious beliefs constitutes one of the two main components of any worldview.

Footnotes

[1]Arthur Eddington, *The Nature of the Physical World* (London: J.M. Dent & Sons Ltd., 1928/1935), 34.

[2]For an account of Kant's Critical method of reasoning, see my book, *Kant's System of Perspectives: An architectonic interpretation of the Critical philosophy* (Lanham, MD: University Press of America, 1993), Chapter II.

[3]See "Kant's Perspectival Foundation for Critical Mysticism", Part Four of my book, *Kant's Critical Religion: Volume Two of Kant's System of Perspectives* (Aldershot: Ashgate, 2000).

[4]Immanuel Kant, *Critique of Pure Reason*, tr. Norman Kemp Smith (London: Macmillan, 1929) , xviii. References cite the second (1787) edition, except that those prefaced with "A" are unique to the first (1781) edition. For an explanation of the "perspectival equivalents" in Kant's text (i.e., the terms that have essentially the same meaning as the word "perspective", which in Kant's day was not yet used in its modern sense), see *Kant's System*, 39-55.

[5]I explain these and other interpretive conventions more fully in *Kant's System*, 55-65.

[6]Kant, *Critique*, xi, xiii, xviii. For a detailed discussion of Kant's Copernican hypothesis, including a selection of typical descriptions by various scholars, see *Kant's System*, 67-69.

[7]For examples of how the perspectival interpretation of Kant enables us to appreciate the deep consistency between Kantian philosophy and the post-Kantian scientific revolutions, see my articles, "Kant on Euclid: Geometry in Perspective", *Philosophia Mathematica* II 5:1/2 (1990), 88-113, and "Kant, Buddhism, and the Moral Metaphysics of Medicine" (co-authored with Adriano Palomo), *Journal of Indian Philosophy and Religion* 7 (October 2002), 79-97. My fuller demonstration of Kant's influence on the other sciences named here comes in *Kant's Critical Science* (in process).

[8]Arthur Miller, "The Special Relativity Theory: Einstein's Response to the Physics of 1905" in Gerald Holton and Yehuda Elkana (eds.), *Albert Einstein: Historical and Cultural Perspectives* (Princeton: Princeton University Press, 1982), 4. See also Albrecht Fölsing, *Albert Einstein: A Biography*, tr. Ewald Osers (New York: Viking, 1997), 158, and Dennis

Overbye, *Einstein in Love: A Scientific Romance* (New York: Viking, 2000), 99, 101-2.

[9]In his attempt to portray Einstein's worldview as superior to Kant's, Morrison interprets the idealist strain in Kant's theory of nature as if it amounts to a Berkeleyan idealism (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], 53), whereby we end up "not hav[ing] an objective system of nature with invariant laws because the forms and categories do not exist independent of the human mind." But few (if any) serious Kant-scholars nowadays think Kant's transcendental philosophy requires such a radically non-realist interpretation. The transcendental conditions, according to Kant, are what make the empirical world real and assure us of its independent (objective) existence.

[10]I defend this interpretation of Kant's theory of geometry in "Kant on Euclid".

[11]Fritjof Capra, *The Tao of Physics*[2] (London: Fontana, 1975/1983), 178, emphasis added.

[12]Friedel Weinert, "Einstein and Kant," *Philosophy* 80 (2005), 585. Insofar as Kant took his views on physics mostly from the received (Newtonian) views of his day, the second part of Weinert's statement need not be regarded as evidence against the thesis I am defending here. As a scientist, of course, Einstein worked out his understanding of concepts such as causality in a far more technical way than Kant (who was concerned with causality as a philosophical principle) would ever have needed to do. Thus, Einstein treated causality in wholly functional terms, associated with the use of differential equations. As we shall see in Part II (§3), the fact that he knew how to apply this philosophical principle to empirical science in ways that would have left Kant's head spinning does not mean Einstein actually rejected, in practice, the role of Kantian causality *as* a transcendental principle.

[13]Jammer points out an interesting correspondence between Kant's and Einstein's views of geometry, when he notes that Kant "anticipated Hermann Minkowski's geometrical representation of relativistic space-time. 'If time is represented,' wrote Kant, 'by an infinitely long straight line and all simultaneous occurrences at a given moment are represented by a transversely drawn straight line through that point on the time line, the thus generated surface

represents the phenomenal world with respect both to its substance and its accidents.'" Max Jammer, *Einstein and Religion: Physics and Theology* (Princeton: Princeton University Press, 1999), 217-18, quoting from Kant's Inaugural Dissertation, *De mundi sensibilis atque intelligibilis forma et principiis* (1770), tr. J. Handyside in *Kant's Inaugural Dissertation and Early Writings on Space* (Chicago: Open Court, 1929).

[14]Ilse Rosenthal-Schneider, "Reminiscenses of Einstein" in Harry Woolf (ed.), *Some Strangeness in the Proportion: A Centennial Symposium to Celebrate the Achievements of Albert Einstein* (London: Addison-Wesley Publishing Company, 1980), 522.

[15]Ibid.

[16]Ibid. Klaus Hentschel casts doubt on Rosenthal-Schneider's claims in "Einstein's Attitude towards Experiments: Testing Relativity Theory 1907-1927", *Studies in History and Philosophy of Science* 23 (1992), 593-624, claiming they were a consciously fabricated story intended to portray Einstein in a Kantian light even though Einstein at that time had a quite different attitude towards the philosophical implications of his empirical science. However, the passage quoted here hardly portrays Einstein in a Kantian light, so even if it is not authentic, we may regard it as a piece of instructive fiction. The "dogs" are an apt metaphor for Einstein's disparaging view of neo-Kantian and logical empiricist (positivist) philosophers who, as we shall see in §§3-4, were vying for Einstein's support, while the "highway" represents Einstein's own youthful experience of the Kant who grounded his worldview.

[17]Albert Einstein, *The Berlin Years: Correspondence, January 1919 - April 1920*, tr. Ann M. Hentschel, Vol. 9 in *The Collected Papers of Albert Einstein* (Princeton: Princeton University Press, 2004), 244. Here, and for all volumes of this work, references cite the document number; but page number(s) are used to cite editors' notes included only in the German edition.

[18]Quoted in Abraham Pais, *Einstein Lived Here* (Oxford: Clarendon Press, 1994), 123.

[19]Ibid.

[20]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.

[21]Ibid., 162.

[22]Einstein, 2004, 33.

[23]Pais, 123.

[24]Ibid.

[25]Ibid.

[26]Einstein, 2004, 104.

[27]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.

[28]Morrison, 51.

[29]Ibid.

[30]Ibid.

[31]Ibid.

[32]Albert Einstein, "Autobiographical Notes", in P.A. Schilpp (ed.), *Albert Einstein: Philosopher-Scientist*[2] (La Salle, Ill.: Open Court, 1949/1969), 9. Einstein states in the first sentence of his landmark paper, "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), that the problem he sets out to solve is that Maxwell's theory "leads to asymmetries that do not seem to be inherent in the phenomena." It therefore seems likely that *symmetry* was at least one aspect of the deeply hidden mystery of nature that fascinated him so much.

[33]For a thoroughgoing discussion of the nature and meaning of this much-misunderstood term

in Kant's philosophy, see *Kant's System*, 143-93, 371-94 (Chapters V-VI and Appendices V-VI). Interestingly, Kant's table of four categories structures the "architectonic logic" of his System in a manner comparable to the way the four cardinal directions structure our interpretation of the movements of a compass (see Chapter III).

[34]Albert Einstein, *The Early Years: 1879-1902*, tr. Anna Beck as Vol. 1 in Diana Kormos Buchwald, et al. (eds.), *The Collected Papers of Albert Einstein* (Princeton: Princeton University Press, 1987), 371 (German edition).

[35]Max Talmey, *The Relativity Theory Simplified and the Formative Period of Its Inventor* (New York: Falcon Press, 1932), 164. This text is frequently quoted, often without reference. See e.g., Jammer, 41n, 42, and Banesh Hoffmann and Helen Dukas, *Albert Einstein: Creator and Rebel* (New York: New American Library, 1972), 24. Some name the medical student as Max *Talmud*, this being his birth name. He changed his name, as many immigrants did, when he moved to the United States (Pais, 123n). I refer to him as Talmey because he used this name when publishing his book. In their notes to a bibliography written by Einstein's sister, the editors of *Einstein's Collected Writings* note an important corroboration of Talmey's report (Einstein, 1987, lxiin [German]): "Einstein's study of Kant was also recalled by one of his Munich schoolmates (Fritz Genewein to Einstein, 23 October 1924)." Fölsing, 25, gives relevant quotes from both sources.

[36]Talmey, 164.

[37]Overbye, 99.

[38]C. Seelig, *Albert Einstein—A Documentary Biography* (London: Staples Press, 1956), 14.

[39]Einstein, 1987, 28; see also 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), 347n (German edition). For an excellent summary of the likely content of Stadler's Kant class, 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. Beller persuasively describes how some of the

very points Stadler emphasized in his class can be observed operating in the scientific revolution Einstein went on to effect. She goes so far as to say (89): "Only by acknowledging Einstein's debt to Kant can we put into proper balance what seem to be contradictory strands in Einstein's epistemological position."

[40]Jammer, 42.

[41]von Weizsäcker, 166.

[42]See e.g., Einstein, 1998, 165. For a thoroughgoing overview of this crucial period of Einstein's mature development, see Thomas Ryckman, *The Reign of Relativity: Philosophy in Physics 1915-1925* (New York: Oxford University Press, 2005). Although the logical empiricists (Reichenbach, Schlick, Carnap, etc.) won the battle against the neo-Kantians (most notably Cassirer, but also similarly-minded writers such as Eddington and Weyl), Ryckman argues that the latter, transcendental idealist interpretation of Einstein provides the only reliable grounding for empirical realism in the philosophy of modern physics. His comprehensive study of this complex and thorny historical period serves as an important complement to my thesis in the present pair of articles: I intentionally avoid discussing this period that came at the height of Einstein's intellectual development, because my interest is in the *grounding* of the worldview that *led* Einstein to his great discoveries of 1905 and 1915. No developments after 1915 are relevant to the present study, except later reports from Einstein and others regarding his early development. Similarly, Ryckman pays no attention to Einstein's early development, never even addressing the question of the philosophical grounding of his worldview. Yet his defense of the transcendental idealist (i.e., Kantian) grounding of relativity theory corroborates the feasibility of my central claim about Einstein's worldview in this pair of articles.

[43]Michael Friedman, *Reconsidering Logical Positivism* (Cambridge: Cambridge University Press, 1999), 18-25.

[44]Ernst Cassirer, *Zur Einsteinschen Relativitätstheorie. Erkenntnistheoretishce Betrachtungen* (Berlin: Bruno Cassirer, 1921); see especially 86, 101.

[45]Michael Friedman, *A Parting of the Ways: Carnap, Cassirer, and Heidegger* (Chicago: Open Court, 2000). For a discussion of Cassirer's debate with the positivists in their quarrel over Einstein's attention, see Ryckman, 13-46 (Chapter 2). But the real heros in Ryckman's account are Hermann Weyl, who used Husserl's phenomenology as a grounding in a way comparable to Cassirer's use of Kant (see Chapter 6 [145-76]), and Arthur Eddington (see Chapter 8 [218-34]).

[46]Weinert, 586n.

[47]Ibid., 588. My account here is brief and incomplete because, as explained in note 42, my purpose is not to review the many twists and turns of Einstein's *mature* development, but only to assess the impact of his childhood love affair with Kant on the worldview we can see operating throughout his writings. The former task has already been carried out in numerous historical studies; most of these are largely irrelevant to the present study because they either ignore or at best underemphasize Kant's role in Einstein's development. For typical examples see Holton and Elkana (eds.), *Albert Einstein*; Don Howard and John Stachel (eds.), *Einstein and the History of General Relativity* (Boston, MA: Birkhäuser, 1989); and Klaus Hentschel, *The Einstein Tower: An Intertexture of Dynamic Construction, Relativity Theory, and Astronomy* (Stanford: Stanford University Press, 1997). Hentschel and others have thoroughly documented Einstein's shift from his early exposure to Kant through materialist and Machian phases to a brief attraction to the early logical empiricism of Schlick and Reichenbach and ending up with the rational realism of his later years. For a recent overview that gives more detailed attention to the various parties who were trying to "save Kant" from the implications of relativity theory, see Don Howard, "Einstein and the Development of 20th Century Philosophy of Science", in M. Janssen and C. Lehner (eds.), *The Cambridge Companion to Einstein* (Cambridge: Cambridge University Press, forthcoming; available online at www.nd.edu/~dhoward1/Einstein's%20Philosophy%20of %20 Science-Cambridge%20Companion-Final%20V.pdf). The developmental issues discussed in these works are also irrelevant to our present concerns because Einstein himself

remained mostly aloof from detailed debates such as that between the neo-Kantians and the logical empiricists.

[48]Peter A. Bucky, with Allen G. Weakland, *The Private Albert Einstein* (Kansas City: Andrews and McMeel, 1992), 112.

[49]See note 36, above. Also quoted in Denis Brian, *The Unexpected Einstein: The Real Man Behind the Icon* (Hoboken, N.J.: John Wiley & Sons, 2005), 8-9.

[50]See e.g., Einstein, 1998, 165, 269, 575.

[51]Ibid., 165.

[52]Ibid., 221n, 347n (German edition).

[53]Ibid., 165.

[54]Overbye, 203.

[55]Ibid., 203-204.

[56]Einstein, 1998, 575.

[57]Ibid., 383n (German edition). Otto Buek's edition of *Immanuel Kants kleinere Schriften zur Naturphilosophie*[2] (Leipzig: Dürr'sche Buchhandlung, 1909), published as volumes 48-49 of *Philosophische Bibliothek*, is an exhaustive collection of Kant's relevant essays on natural philosophy.

[58]Einstein, 1998, 575.

[59]Ibid., 575.

[60]Ibid., 575. Jammer, 42-52, discusses these and other influences.

[61]Barry Parker, *Einstein: The Passions of a Scientist* (Amherst, NY: Prometheus 2003), 32, 38-39.

[62]Ibid., 33.

[63]Ibid.

[64]Ibid., 34.

[65]Ibid., 34.

[66]Denis Brian, *Einstein: A Life* (New York: John Wiley & Sons, 1996), 6-7, reports these

events in much the same way.

[67]Ibid., 104.

[68]Andrew Robinson, *Einstein: A Hundred Years of Relativity* (Bath: Palazzo Editions, 2005), 158.

[69]Robinson (ibid.) claims he was not; Overbye, 272-4, claims he was.

[70]Ibid.

[71]Quoted in Brian, 1996, 105.

[72]Robinson, 158. This trend culminated in 1931 with the publication of a book entitled *Hundert Autoren gegen Einstein*, composed of 28 short essays by members of the "anti-relativist" movement. For a discussion of this work, see Hubert Goenner, "The Reaction to Relativity Theory in Germany, III: 'A Hundred Authors against Einstein'", in John Earman, Michel Janssen and John D. Norton (eds.), *The Attraction of Gravitation: New Studies in the History of General Relativity* (Boston: Birkhäuser, 1993), 248-273.

[73]von Weizsäcker, 167-68.

[74]Brian, 1996, 105.

[75]Einstein, 1949/1969, 9.

[76]Ibid., 13.

[77]Einstein, 1998, 618.

[78]Einstein, "Reply to Criticisms: Remarks to the Essays Appearing in this Collective Volume", in Schilpp, 680.

[79]For Part II of this series, see "The Kantian Grounding of Einstein's Worldview: (II) Simultaneity, Synthetic Apriority and the Mystical", *Polish Journal of Philosophy* IV.2 (Fall 2010), ##-##.