Commentary by Gerald Holton for the Einstein Symposium papers at the British Academy

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Commentary by Gerald Holton for the Einstein Symposium papers at the British Academy on March 5, 2005

Ladies and Gentlemen, I am delighted that we are having this meeting at the British Academy. Because of this distinguished venue it may not be out of place if I preface my comments on Professor Howard’s paper with some remarks close to the purposes of the British Academy as set forth in its charter of 1902: “The British Academy for Promotion of Historical, Philosophical and Philological Studies.” I have long defended the view that the humanistic and social science context of a work in physical science is often an essential prerequisite for understanding its full cultural significance. It can be very revealing to trace the cultural roots that helped shape scientific ideas in the first place, for example, the literary or philosophical aspects of the cultural milieu in which the scientist grew up and flourished. The physicist and polymath Erwin Schrödinger indicated in 1932 that the pursuit of science and even its content at a given era may well be conditioned by, or as I would prefer to say, be in resonance with, “the larger cultural milieu.” This point of view has already been amply confirmed in historical studies over the years, for example, on the works of Johannes Kepler, of Galileo, of Newton, and of the 18th-century Naturphilosophen such as Hans Christian Oersted. This attitude found its eloquent expression in Robert K. Merton’s seminal 1938 monograph when he wrote, “The cultural soil of the 17th-century England was peculiarly fertile for the growth and spread of science.” [Robert K. Merton, *Science, Technology and Society in 17th-Century England* (first published 1938, p. 238)]

If we shall now consider aspects of Albert Einstein’s early work, it is fair to ask whether in his case, too, there was some resonance between his physics and the cultural soil of the time which nourished his imagination. While the rich evidence at hand can be indicated only briefly here, there is no doubt that Einstein himself and many of his major contemporary scientists and role models had a conception of their role rather different from that of most scientists today. Indeed, Einstein himself made this clear often and in many ways. In his *Autobiographical Notes*, he said, “The type of critical reasoning which was required for the discovery [during his work on relativity theory] of the central point
[the absence of absolute time], was decisively furthered by the reading of David Hume and Ernst Mach’s philosophical writings.” [p.53] Earlier, in his 1918 essay in honor of Max Planck, he revealed his extensive preoccupation, saying that the highest duty of a scientist is to furnish “a product that deserves the proud name of a world picture” [Weltbild] [I.O., p. 221] Indeed, in the late 19th and early 20th century, especially in Germany, one reads over and over again from a great variety of authors that the fundamental motivation for a scientist is to contribute to the building of the world picture. As Ernst Mach, whose works Einstein read early and with delight, put it in The Science of Mechanics: “Science cannot settle for a readymade worldview….We must earn it! [At the end there beckons the idea of a unified worldview, which is the only one consistent with the economy of a healthy spirit”]

Indeed, in publication after publication, German scientists, even while perhaps working on a narrow problem, were calling for the unification or reformation of the whole world picture in the very title of their books and essays. And while great battles were carried on between rivals such as Max Planck and Ernst Mach, they did agree that their aim was to arrive at “the unity of the physical world picture.” The same sort of publications came from many of Einstein’s own close friends and associates, such as Friedrich Adler, Max von Laue, Aurel Stodola, Ludwig Hopf and Philipp Frank. And, importantly, the search for the physical world picture itself was only one aspect of a greater, more far-reaching quest. This was most simply revealed in the 1912 Manifesto, whose declared aim was nothing less than “to develop a comprehensive Weltanschauung” and thereby “to advance toward a non-contradictory, total conception [Gesaumtauffassung]” across all scientific fields. That document was signed by among others Ernst Mach, the mathematician David Hilbert, Felix Klein, Albert Einstein (only just becoming widely known), the sociologist and political scientist Ferdinand Tönnies, the engineer Joseph Popper, J. C. S. Schiller, the philosopher at Oxford, the biologist Jacques Loeb, and a number of others in various professions.

During the years 1902, ’03, and ’04, when the ideas for the miraculous year of 1905 were germinating in Einstein’s mind, he was meeting, sometimes several times a week, with friends such as Conrad Habicht and Maurice Solovine in the famous self-arranged Akademie Olympia, whose purpose was to discuss ideas, especially those
coming from certain books. From several sources, but particularly from Maurice
Solovine’s publication of his letter exchange with Einstein (Paris, 1956), we know some
important facts that shed light on the interplay between science and the rest of culture as
then understood by Einstein and his friends. Let us spend a moment on these events,
starting with some remarks from Solovine himself. In early 1902, he happened to come
across an advertisement in a journal in Bern, placed there by Albert Einstein, offering
lessons in physics for 3 francs an hour. (Einstein had to survive on this, waiting for the
final definite nomination to the Patent Office.) Solovine, a philosophy student, took
advantage of this offer, but after a few preliminary meetings during which physics was
discussed, Einstein surprised Solovine by proposing to turn to readings that would be
“more interesting.” They now turned to “the works of grand masters,” starting with Karl
Pearson’s *Grammar of Science*.

Joined by Conrad Habicht, the list of the next works studied and discussed, as
given by Solovine, concerned the “most important problems of science and
philosophy”—two books by Ernst Mach, which Einstein had already read, the *Logic of
Mill*, the *Treatise of Human Nature* by David Hume, the *Ethics* of Spinoza, *Memoirs
of Helmholtz*, some essays on the philosophy of science by Ampère, and so forth,
concluding the list with *Science and Hypothesis* by Poincaré, *Antigone* by Sophocles, and
other classics. From time to time, Einstein entertained his friends by playing his violin.

These meetings were of course not a matter of random self-education. Rather,
Solovine makes the important remark, “At the end of the 19th and the beginning of the
20th century was the heroic time of researchers on the foundations and principles of
science, and that was our constant preoccupation.”

The description of the cultural soil that nourished Einstein as culture carrier and
scientist could go on and on. His own extensive writings outside pure science testify to
this effect impressively. And of course he was not alone in this. The publications by
prominent scientists at that time—Helmholtz, Ernst Mach, Max Planck, Boltzmann and
many of the masters, and friends such as Moritz Schlick and Philipp Frank—reveal them
all to be deeply culturally engaged. That was part of being an important or aspiring
scientist. This combination of interests of early 20th-century scientists and their function
as nature philosophers of their sort, is perhaps difficult to understand by scientists of today. There are now fewer and fewer such models.

But regarding Einstein in the light of history, we shall not be surprised by his attention to the cultural context and epistemological problems throughout his scientific work. In fact, it all had started with him very early. We know that a young impoverished student, Max Talmey, who was allowed to eat with the Einstein family for some years, beginning when Einstein was about 10 years old, introduced Einstein to philosophical ideas, such as Kant’s *Critique der reinen Vernunft* at the tender age of 13, Ludwig Büchner’s *Energy and Matter*, chiefly a late-Enlightenment polemic on behalf of what it’s author called “a materialistic worldview,” the *Kosmos* of von Humboldt, Bernstein’s popular science volumes, with Einstein, according to his sister’s biography, “thirsty for knowledge” as a child. Indeed, one of the earliest documents in the *Collected Papers* of Einstein, in Vol. 1, document 4, dated 1891-95, the period during which Einstein was between 12 and 16 years old, is a fragment in Einstein’s hand, titled “Two Philosophical Comments.” One is largely a copy of a passage from Johann Friedrich Herbart’s *Introduction to Philosophy*, but to that Einstein added a remark on Leibniz. His second comment referred again to Leibniz and also to Poisson, Herbart, and others. He reread Kant at sixteen, and while a student at the Technical Institute in Zürich, young Einstein enrolled in an optional lecture course on Immanuel Kant, taught by the eminent August Stadler. In 1918, he wrote to Max Born that he was reading Kant’s *Prolegomena*, saying he was “beginning to comprehend the enormous suggestive power that emanated from that fellow (*von diesem Kerl)*.” Later, Einstein wrote a lengthy review of a book analyzing Kant’s philosophy, and he referred repeatedly to Kant’s ideas in his conversations and correspondence.

All this of course did not at all make Einstein a follower of transcendental idealism; but it is the background to Einstein’s own twist. He explicitly freed Kantian Categories from their unalterable *a priori*, letting his version be chosen freely, and thus making them a central tool in Einstein’s epistemology.

With this historical background, I turn to my specific Commentary on Don Howard’s paper, “And I shall not Mingle Conjectures with Certainties.”
In Professor Howard’s prepared paper on Einstein’s epistemological concerns, especially the distinction between constructive theories and theories of principle, there is a key sentence where he writes that Helmholtz remarked that scientific inquiry would be led astray without first undertaking an *epistemological critique* of the conditions necessary for the possibility of scientific knowledge. This sentence illuminates a question that might have occurred to you: Which distinguished and busy physicist of today would argue year after year about the difference between principles, theories, constructive or otherwise, or heuristic points of view? To be sure, they might be elevated by a satisfying result that makes physics more beautiful. But from our twenty-first century point of view, we have to put on some glasses to realize that in the last part of the 19th century, and even in Einstein’s time, the question about the veracity of scientifically grounded statements was much more lively than it is today among our scientists.

Einstein was still caught up in those debates, as were many of his colleagues. Einstein’s interest in philosophy and particularly philosophy of science, alive already since he was a boy, finds published expression as early as 1914 in his inaugural address before the Prussian Academy of Sciences, which was to be his steady place of attendance for much of his stay in Berlin. His address is entitled “The Principles of Theoretical Physics.” There, he says early on, “The theorist’s method involves his using as his foundation general postulates or ‘principles’ from which he can deduce conclusions. His work thus falls into two parts. He must first discover his principles and then draw the conclusions which follow from them. For the second of these tasks, he receives an admirable equipment at school….The first of these tasks, namely, that of establishing the principles which are to serve as the starting point of his deduction, is of an entirely different nature. Here there is no method capable of being learned and systematically applied so that it leads to the goal. The scientist has to worm these general principles out of nature by perceiving in comprehensive complexes of empirical facts certain general features which permit of precise formulation.” (pp. 216-217, Ideas & Opinions)

Almost 40 years later (May 7, 1952), still writing to his old friend, Maurice Solovine, Einstein essentially repeats this while adding a splendid visual illustration of what he means.
In between these dates, Einstein had attended to what he calls in his Solovine letter the “epistemological matter” repeatedly. In 1919 he published two essays that show Einstein’s preoccupation. One, the essay, “Induction and Deduction in Physics,” published in the *Berliner Tageblatt*, is in rather strange company, surrounded by several other authors with heavy patriotic messages, because the purpose of that supplement page was to discuss the situation in Germany a year after the war had ended. But Einstein took refuge into epistemology instead of into patriotic ecstasies. And in his 1919 essay, “Time, Space, and Gravitation,” for the *Times* in London—also interesting in its context as one of the earliest German scientists writing again for a British newspaper—we once more find him discussing constructive theories versus the other kind, of which he says “I will call principle theories.”

It is surely worth noting here that Einstein had considerable difficulty with the use of the word *theory* in his own work on relativity, starting from 1905, in the paper which this year is being celebrated. Of course he did not use the words “relativity theory” in the paper itself, preferring “relativity principle,” and from 1905, never used relativity theory in a title of his several essays until in 1911, in a speech in Zurich, he did allow the publication to have the title “*Die Relativitätstheorie.*” The important book by Max von Laue of 1911 also was titled still “*Relativitätsprinzip*” until later editions changed it. Einstein himself did not return to *Relativitätstheorie* used in the title of an article until 1913, when he wrote the outlines of a generalized relativity theory. The discomfort that he seemed to have with calling his own work “theory” may be also reflected in the fact that even in 1914 he wrote on the relativity problem and again on the relativity principle. In the text of one of his early papers he even writes, “the so-called relativity theory.”

While Professor Howard does not bring it forth specifically, there is hidden behind some of his essay a curious puzzle. It has to do with Einstein’s difficult relation with the ideas of Ernst Mach. As Professor Howard writes early, quoting Einstein’s Autobiography, “Shortly after 1900,” Einstein despaired of finding laws via constructive efforts based on known facts. “Gradually, I came to the conviction that only the discovery of a universal formal principle could lead us to assured results.” But giving priority to universal formal principles is of course completely contrary to the ideas of Ernst Mach, with whom Einstein was then still corresponding warmly, ending a letter in
1909 with the salutation, “Your admiring student,” and continuing to write to him until 1913, when he unfortunately enclosed his first paper on the generalized relativity theory (with Grossmann). Einstein’s outwardly positive attitude changed after Mach’s death in 1916. Writing to Besso on the 13th of May 1917, Einstein memorably says, “Mach’s little horse…cannot give birth to anything living, it can only exterminate harmful vermin.” In a letter to his old friend Cornelius Lanczos, 24 January 1938, Einstein wrote about his pilgrimage: “Coming from sceptical empiricism of somewhat the kind of Mach’s, I was made, by the problem of gravitation, into a believing rationalist. That is, one who seeks the only trustworthy source of truth in mathematical simplicity….”

Perhaps without fully realizing it, Einstein had been slowly coming to the side of Max Planck, who in his attack on Ernst Mach in 1909, in his essay “The Unity of the Physical World Picture,” opposed Mach’s phenomenalism and sensationist point of view, and wrote that the basic aim of science is “finding of a fixed world picture independent of the variation of time and people.”

By 1929, in an essay for a Festschrift for Aurel Stodola, Einstein goes even further, writing that in knowing why nature is thus and not otherwise, “Here lies the higher scientific satisfaction of a scientific person…. [On making deductions from a fundamental hypothesis such as that of the kinetic molecular theory] one experiences, so to speak, that God Himself could not have arranged those connections [between pressure, volume and temperature, etc.] in any other way than that which factually exists…. Here has always been for me the particular magic of scientific considerations; that is, as it were, the religious basis of scientific effort.” And writing to Moritz Schlick a year later, 28 November 1930, Einstein goes the rest of the distance by declaring that “physics is the attempt at the conceptual construction of a model of the real world and of its lawful structure…. In short, I suffer under the (unsharp) separation of Reality of Experience and Reality of Being.” And he adds, “You will be astonished about the ‘metaphysicist’ Einstein. But every four- and two-legged animal is de facto in this sense metaphysicist.” By now, there is hardly any discernible distance between the philosophical views of Einstein and Planck.
I have offered these remarks on the background behind the controversies noted in Professor Howard’s paper, hoping thereby to supplement the understanding of his fine paper.

**Commentary on Robert Schulmann’s paper, “Beware of Rotten Compromises: The Moral Foundations of Einstein’s Politics.”**

Dr. Schulmann’s paper centers on what he considers to have been for Einstein “a deeply important truth: “Only someone who is truly independent can remain free enough to act morally.”

The moral compunction of Einstein, which undoubtedly has a large internal source from the beginning, also must have had some reinforcement externally. We know from his Autobiography and other sources that as a child he went to a Catholic school for the first few years, being exposed there to some of the doctrines and teachings of that faith, and, in addition, was given by family friends also some education in the Jewish religious faith. All this helps to explain perhaps why Einstein begins his *Autobiographical Notes* of 1947 with the reminiscence that in his early years and until the age 12, he “came…to a deep religiosity,” which he identifies as his youthful “religious paradise.”

Dr. Schulmann properly emphasizes that young Einstein, from his days in Switzerland on, had the “pride of being footless,” “everywhere an outsider,” “living the gypsy life.” One could take a step further beyond this lifelong characterization of Einstein. To be sure, Einstein’s reputation as an obstinate, anti-authoritarian nonconformist and defiant rebel, even as a vagabond, as he repeatedly described himself, all this is solidly grounded in many of his actions, and it is also lively in the popular imagination. But there is equal evidence for viewing Einstein as a cultural traditionalist, even of the kind that the sociologist Karl Mannheim identified as a “free-floating intellectual,” one without a well defined anchor in society. More than that, there is evidence that even Einstein’s science itself had roots in the standard *Kultur* of the period of his youth and his early years, in the European and especially in the German literary and philosophical cultural tradition.
Many German young men at that time had the choice of becoming either what has been called a Mandarin, a member of and subservient to higher political authority, or, on the other hand, remaining free from that and opting for being a culture-carrier, a *Kulturträger*, and by being not a Mandarin, remaining more truly independent and therefore remaining more free to act morally. Einstein clearly preferred the second path without ever adopting that name consciously. But he went through the process by which the German youth of his day acquired the products and attitudes of *Kultur*, as we can glean that even from his curricula at his Munich Gymnasium and his school in Aarau, designed for the preparation of young aspirants to the *Bildungsbürgertum*. We also have the extensive reading lists of books Einstein discussed at length with his friends in Bern, at their Akademie Olympia, and also the books that he had in his own library to the end of his days. Looking only at one example, namely the German-language books published before 1910 which survived in Einstein’s household in Princeton, the list includes much of the canon of the time: For example, Boltzmann, Büchner, Hebbel, the collected works of Heine in two editions, Helmholtz, von Humboldt, many books of Kant, Lessing, Mach, Nietzsche, and Schopenhauer. But what looms largest are the collected works of Goethe, in a thirty-six volume edition, and another of twelve volumes, plus two volumes on his Optics, one on the exchange of letters between Goethe and Schiller, and also a separate volume of *Faust*. So it is no surprise that when he was still a student at the Zürich Polytechnic, young Einstein, still regarding himself as a kind of bohemian at war with the “philistines,” also took a second optional course, while preparing to become just a high school science teacher. The title of that course was nothing less than “*Goethe, Werke und Weltanschauung*."

Toward the middle of his paper, Dr. Schulmann writes about Einstein’s experiencing the “failed expectations of his parents” for commercial success, and on p. 15, Einstein’s “resolute ambition and opportunistic pragmatism, conditioned also by a determination to succeed where his father had failed.” [Kinder]

Later in his paper, Dr. Schulmann writes that at the beginning of World War I, Einstein’s “moral outrage at the German violation of German neutrality…derived directly from his instinctive internationalism.” For this important aspect of Einstein’s personality there are very many examples, by no means the least being his Royal Albert Hall speech
in London in October 1933, where he said, “I am…a good European.” In fact, whenever he could, he rejected a nationality label, starting with his early flight from Munich to Italy and Switzerland, renouncing his German citizenship at the time. From 1914, and most memorably in 1933, after having again discarded his German citizenship, he declared himself to be a European, at a time when Europe meant chiefly only a geographical entity. Long before the pioneering vision of Konrad Adenauer, Jean Monnet, Robert Schumann, and Paul Henry Spaak, Europe existed as a political and economic entity chiefly in the imagination of the likes of G. F. Nicolai, whose ill-fated manifesto of October 1914 called for the creation of “an organic unity of Europe,” or, from the ‘20s, in Count Coudenhove-Kalergi and his supranational Pan-Europa movement. That movement counted among its members Sigmund Freud, Thomas Mann, Rilke, Unamuno—and Einstein, who even wrote an article on Pan-Europa, and spoke out in defense of what he called “European civilization.” Again, as in his science, Einstein prophesized Europe’s eventual unification, just when that was thought by almost all others to be blatantly utopian and impossible. Going beyond that, I venture to think Einstein would have been happiest with the designation “world citizen.”

Among Einstein’s writings there are many on ethics. One of my favorites is a rather obscure one, his foreword, entitled “The Laws of Science and the Laws of Ethics,” to Philipp Frank’s book, Relativity, A Richer Truth (Beacon Press, 1950). There Einstein concentrates on certain analogies between finding the laws of those two different fields. Thus he writes, “If we can agree on some fundamental ethical propositions, then other ethical propositions can be derived from them, provided that the original premises are stated with sufficient precision. Such ethical premises play a similar role in ethics to that played by axioms in mathematics.” And, he might have added, “in principles in physics.” He then asks where those principles or axioms might be found, and answers that “it is the privilege of man’s moral genius, expressed by inspired individuals to advance ethical axioms which are so comprehensive and so well founded that men will accept them as grounded in the vast mass of their individual emotional experiences….Truth is what stands the test of experience.” Elsewhere he identified who these inspired individuals, able to outline the ethical axioms, might be: Moses, Jesus, and Buddha.
And finally, there is one more person that should be mentioned when speaking of Einstein’s moral foundations. It is Baruch Spinoza. Einstein read Spinoza’s *Ethics*, constructed along the lines of a text on Euclidean geometry, perhaps first in the period of 1902 to 1904, and reread it many times thereafter. He considered Spinoza one of the great spirits (he names as the others Democritus and St. Francis of Assisi), those who had attained what was to Einstein, from 1930, on more and more important: the “cosmic religious feeling.” Spinoza’s work and life often preoccupied Einstein. He wrote an introduction to a biography of Spinoza (1946), contributed to the Spinoza Dictionary (1951), and referred to Spinoza in many of his letters, even composing a poem in Spinoza’s honor. He admired Spinoza for his independence of mind, his deterministic philosophical outlook, his skepticism about organized religion and orthodoxy, which had resulted in Spinoza’s excommunion from his synagogue in 1656, and even for his ethical preference that had compelled him to remain in poverty and solitude, to live in a sort of spiritual ecstasy, instead of accepting a professorship at the University of Heidelberg.

For Spinoza, God and nature were one. And this came to be true also of Einstein, while he, from 1930 on, developed his ideas of a Spinozistic cosmic religion. One might call it Einstein’s final paradise, in which his yearnings for science and religiosity were joined. Perhaps this component of Einstein’s soul helped him also to remain, in Professor Schulmann’s words, “free enough to act morally.”