

letters

elementary probability theory to predict the reliability of the SSC from the known performance of the Tevatron.

Experience with the Tevatron is limited. During the period of operation, the "availability" of the Tevatron—that is, the fraction of scheduled up-time that the Tevatron was actually available for experiments¹—was 64.4%. We would thus predict an availability for the SSC of (0.644)¹⁰, or 1.2%, which is obviously unacceptably low.

Thus, because the SSC will have ten times as many components as the Tevatron, the reliability of the individual components, and in particular of the superconducting magnets, is more critical for the SSC than for the Tevatron. The SSC will have nearly 10 000 magnets and each time any one of them needs to be replaced, the whole machine will be down for a full seven-day week.¹ However, because both the peak field strength and the variation in field strength over a cycle will be larger for the SSC magnets than for the Tevatron magnets, it is even possible that the magnets of the SSC will be less reliable than those of the Tevatron.

The moral of the story is that even in the absence of budgetary constraints, we cannot continue to build larger and larger particle accelerators *ad infinitum*. Sooner or later, Murphy's law of complex systems—"The larger and more complicated a system is, the more likely it will be to break down and the harder it will be to fix when it does" (R. D. Murphy, private communication)—will intervene to impose its own constraints.

References

1. SSC Central Design Group, *Conceptual Design of the Superconducting Super Collider*, SSC-SR-2020, Lawrence Berkeley Laboratory, Berkeley, Calif. (March 1986).
2. Fermilab Highlights (March 1986).

ROBERT J. YAES

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7/86

THE ASSOCIATE DIRECTOR OF THE SSC CENTRAL DESIGN GROUP REPLIES: Robert Yaes has pointed out, in effect, that reliability will be a serious problem for the SSC, with its 10 000 superconducting magnets. His point is well taken, and it has been well taken since the very beginning of the R&D program that was undertaken to develop a design for this new, proposed accelerator. Yaes may rest assured that we have made and are making appropriate Bayesian analyses of the simultaneous availability of 10 000 such magnets

under various conditions of individual reliability. Among the most important design parameters for these magnets will be reliability and lifetime. We are confident that in spite of the large number of individual parts, the SSC collider rings will perform with a duty factor that is quite comparable to that of current-day accelerators. It's not easy, but we are confident that it can be done.

My guess is that if Yaes applied the same reasoning he has used in the case of the SSC to the step from the Bevatron to the Proton Synchrotron at Brookhaven or from the Proton Synchrotron to the initial, 400-GeV accelerator at Fermilab, he would come to much the same conclusion in each case, that is, that the next step in size would never work. Perhaps one of the important contributions to technology stemming from each of these steps in accelerator construction has been the development of highly sophisticated systems that operate at a comparably high level of reliability.

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Einstein and Germany

The article "Einstein and Germany" by Fritz Stern (February 1986, page 40) is spendidly evocative, but can we be sure that it represents in every way the facts as they are known? I say this because much mythology has grown up about Albert Einstein's life, and most secondary sources—including Alan D. Beyerchen's book, which Stern used—are not always reliable. For the evidence of this and other statements in this letter, see my article "Einstein, general relativity and the German press, 1919–1920."¹

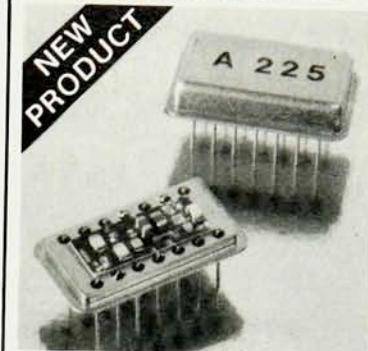
One such myth concerns Einstein's fame in Germany immediately after the solar eclipse announcement in November 1919 and the idea that this fame was connected with the fact that Germany in its humiliation was looking for an acceptable hero figure. (Stern writes, "The new hero appeared, as if by divine design...") I have not been able to find any evidence for such a view in the contemporary German press, which—in contrast to the British and American press—treated Einstein with dignity and without sensationalism.

A more serious error in Stern's article concerns the 1920 edition of Philipp Lenard's book on relativity. This did not contain anti-Semitic remarks, and Einstein himself, in writing to Arnold Sommerfeld on 11 September 1920,

continued on page 106

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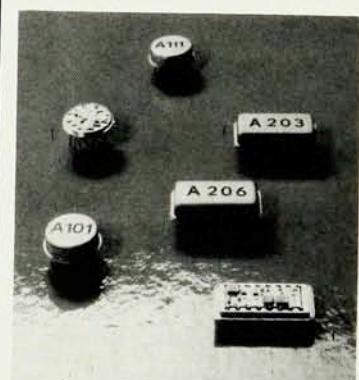
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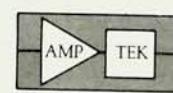
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used the phrase "very decent" in describing Lenard's treatment of him in the book. Unfortunately, in replying in the *Berliner Tageblatt* of 27 August 1920 to earlier attacks by Paul Weyland, Einstein made a personal attack on Lenard: "I admire Lenard as a master of experimental physics, but he has not achieved anything in theoretical physics and his objections to the general theory of relativity are of such superficiality that I did not think it necessary until now to answer them in detail. I am thinking of repairing this omission." After that, the next edition of Lenard's book did indeed contain anti-Semitic remarks.

Correctness in points like this is not unimportant in any attempt at interpreting the position and attitudes of Jews in Germany in the early 1920s. As Stern says, "Like so many thinkers of the 1920s Einstein underestimated the force of the irrational, of what the Germans call the demonic, in public affairs." Correctness is also important in any attempt to fathom Einstein's personality, which surely should be made in spite of Stern's description of Einstein as an "unfathomably complex person."

Reference

1. L. R. B. Elton, *Isis* 77, 95 (1986).

L. R. B. ELTON

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I would like to object to the general tenor of Fritz Stern's article "Einstein and Germany," according to which Nazism was a more or less direct consequence of German nationalism and was, or could have been, foretold by Albert Einstein and others. The reasons for World War I and its consequences should perhaps not be sought so much in German nationalism as in Germany's military and economic strength and in a European mood of preparedness for war at that time. I also have the impression that Stern mixes up nationalism with racism. To blame the Germans alone for all the tragedies that have occurred in Europe during this century is simply unfair. I am also unable to follow Stern's remarkable characterization of Germans as having an "inborn servility."

Stern's method of taking a time integral over a hundred years of German history to draw some general picture of Germany or of Germans is not very helpful, since such one-sided articles are also read by younger Germans, who, though very critical of the

older German generation, are no less critical of the world around them. Some weeks ago, before I had read Stern's article, a 22-year-old student in Kaiserslautern told me she has the impression that some Jews intend to stigmatize (*brandmarken*) all Germans forever, not only the Nazis.

Although on page 40 Stern obviously promises not to treat Germany's past with didactic simplicity, the article contains a number of generalizations. For example, in Einstein's time school-teaching in Germany was certainly characterized by a predominantly "authoritarian" style, but it is plain nonsense to "rightly refer to 'the German habit of gilding school failure with the suspicion of hidden genius.'" Stern gives the impression that at the beginning of World War I, with but few exceptions, German "intellectuals everywhere" had nothing else to do than to join "in this chorus of hatred and in the cry for blood," as "did the guardians of morality and the servants of god, the priests who sanctified the killing as an act of mythical purification," whereas some others passed some patriots "on the right in the nation's wild leap to pan-German madness." Unfortunately, such or similar things actually occurred, but I question whether German priests blessed the soldiers or whatever to "sanctify the killing as an act of mythical purification."

Stern cites a letter by Einstein that implies that Max Planck was "40% unnable," without giving any more information on possible justified accusations against Planck by Einstein. Stern complains that "in 1920 a well-known physicist opposed the university appointment of the later Nobel laureate Otto Stern" by stating, "I have high regard for Stern, but he has such a corrosive Jewish intellect." I cannot see why Stern does not mention that physicist, who perhaps himself had a "corrosive mind," by name.

Stern states that Nobel laureate Philipp Lenard, in his 1920 pamphlet *Über Relativitätsprinzip, Äther, Gravitation* (first edition, 1918), argued that Einstein's relativity theory is false. According to Stern, Lenard attacked Einstein not only as a publicity-seeking theorist but also as a Jew. As a matter of fact, Lenard merely argued that it was "too early" to consider Einstein's theory of special relativity a final theory reflecting an absolute truth. Lenard's own answer to the null result of the Michelson-Morley experiment was that there is an individual ether associated with every atom, which has no corpuscular microscopic structure. In the second edition of his pamphlet *Über Äther und Uräther* (1922), Lenard

does complain about public exploitation of Einstein's theory. The complaint may have been justified, because some people tried to derive general philosophies of life from special relativity, such as "Everything is relative." Stern also distorts historical facts by giving the impression that Lenard's objection to premature acceptance of Einstein's special relativity may be reduced to the circumstance that Einstein was Jewish, and by concealing that Einstein had attracted criticism from many physicists for not having given reference to previous work by Friedrich Hasenöhrl, who stated the law of proportionality between energy and inertial mass, $E \propto mc^2$, prior to Einstein.¹ Although I have not found the terms "Jew" or "Jewish" in Lenard's pamphlets, in the 1918 and 1922 editions, respectively, it is true that in a preface to the second edition of *Über Äther und Uräther*, entitled "A dunning word to German scientists," one finds an unnecessary polemic remark, which roughly translates as follows: "To announce the name 'relativity theory' is, given the present state of affairs, deceit. [Lenard used the word *Trug* (deceit, illusion), not the word *Betrug* (betrayal, fraud).] Still, much more fatal—and therefore especially sad—is, however, another notional confusion not hidden from those acquainted with ethnology, which hovers around Mister Einstein as a 'German' scientist."

It is an oversimplification to assume that the relation between Einstein and Lenard was first of all a conflict between a patriot and a non-patriot (unless one assumes Einstein's opposition during the war years 1914-18 was not purely passive). The proposition that Lenard was a radical anti-Semite so shortly after World War I (that is, in 1920, when his skeptical pamphlet was first published) is not trustworthy either, because he certainly must have known that many German Jews had been better patriots than many non-Jewish Germans at that time. However, the arrogance of the younger Einstein, only touched upon by Stern, may have played some role. I recently found an Einstein biography,² a thick book, which was introduced with a quote where Einstein characterized himself as having "little patience with physicists who drill many holes at places where the planks are thinnest." It can hardly have been Einstein's business where other physicists drill their holes, and how many. Since Einstein apparently also did not do much to limit the public noise around his theory of special relativity, which superseded Hendrik Lorentz's and Hasenöhrl's earlier, fragmentary theor-

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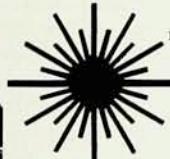
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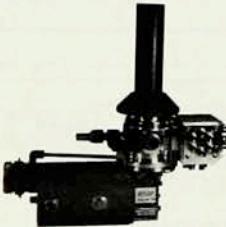
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letters

ies,³ and since the theory also had been celebrated as "a triumph of German Jewry" (anybody in Germany who tried to celebrate some physical theory as a triumph of, say, Catholicism, Protestantism or Buddhism would hardly have been taken seriously, and I think rightly not, because the exact sciences and religious, racial or nationalistic ideas should not be intermingled), he must have appeared in some respects to Lenard like some kind of "Rambo of theoretical physics."

As long as a unified field theory explaining all elementary particles as well as gravity has not been found, there is no reason to trust blindly in any existing physical theory, not even Einstein's special relativity, despite the overwhelming experimental evidence. Special relativity would be outdated as soon as our present notion of mass needed to be revised or if it could be shown that "local time" depends on matter waves.⁴ When the epistemological foundations of nearly all physical theories are fairly uncertain, I cannot see why one single physicist should be glorified. The personal cult around Einstein puts unsurmountable psychological barriers up in front of many students and scientists. Although Einstein developed special relativity when young, many textbooks contain pictures of the old Einstein looking like a saint or wise man, not as the rebel he, according to Stern, originally was. Many students might wrongly think that what Einstein did was so exceptional that they never could do similar things, or that they will have to wait until they become old and wise before they can achieve something similar. One should not be surprised, then, that few scientists are interested in the problems associated with the foundations of modern physics.

References

1. M. Born, *Atomic Physics*, 7th ed., Blackie, London (1965), p. 56.
2. R. W. Clark, *Einstein: The Life and Times*, Hodder and Stoughton, London (1973).
3. For historical accounts of special relativity see, for example, E. Zahar, Br. J. Philos. Sci. **24**, 95, 223 (1973); K. D. Stiegler, in *Proc. XIIIth Int. Cong. of the History of Science, Moscow, 18-24 August 1971, Sect. VI: The History of Physics and Astronomy*, p. 53.
4. W. Krause, in *Progress in Space-Time Physics 1987*, J. P. Wesley, ed., Benjamin Wesley, Blumberg, FRG (1987), p. 51.

W. KRAUSE

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STERN REPLIES: I received copies of the

letters by W. Krause and L. R. B. Elton in late April 1987.

Krause's letter not only misconstrues the intent of my article, but repeatedly attributes to me opinions which I explicitly quoted from others. Thus it was Einstein who spoke of "the inborn servility" of the Germans and it was Erik Erikson whom I quoted about interpreting school failure. As to the behavior of the German clergy during World War I, Krause might wish to read the observations of one of the greatest theologians of the century, Karl Barth. Krause clearly does not observe the elementary canons of scholarly-scientific method, and I see no point in dealing with his insidious innuendos. I regret them and know that they are unrepresentative of current German academic attitudes.

I am grateful for Elton's letter with the reference to an important article that appeared *after* the publication of my essay. My remark about Philipp Lenard's attack on relativity as "a Jewish fraud" is correct, but I regret that the picture of Lenard's pamphlet of 1920 and the caption could be interpreted as suggesting that this anti-Semitic remark was made in *that* pamphlet. I am sorry that by an accident a misunderstanding has arisen.

In an essay, "Fraternal opposites: Fritz Haber and Albert Einstein," which I delivered in February 1986 for a forthcoming festschrift for the 75th anniversary of the Max Planck Society, additional details about the work of Haber and Einstein in the incomparable atmosphere of Berlin before 1933 can be found.

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Physics Olympiad

I am delighted to hear that US high school students participated in the International Physics Olympiad in 1986, and that they did so well (PHYSICS TODAY, September 1986, pages 51 and 120).

As a matter of history, it was Science Service that first suggested AAPT involvement. I attended the 1981 Olympiads in Varna, Bulgaria, as an observer, and also attended a round table on national programs, which involved some 12 different countries. I collected a large amount of material, which I duplicated and sent to the AAPT upon my return.

At that time, Science Service was considering the development of an olympiad program (both in physics and in chemistry), and thought that the