

The first of two articles

Einstein, relativity, and the press

The myth of incomprehensibility

JEFFREY CRELINSTEN

Albert Einstein first became world-famous in 1919. He was 40 years old, already ranked among the highest in his field, and held the most prestigious position within the community of theoretical physicists as professor of physics in the Kaiser Wilhelm Gesellschaft at Berlin. Before the British astronomers announced that they had measured the bending of light in the vicinity of the sun, Einstein was not well known to the public at large. Within weeks of the announcement of the verification of his theory of relativity he was discussed and sought after by people all over the world. From that time on, fame never left him.

Today the name of Einstein is known by practically everyone; most people know that he had a theory called relativity but hardly any of them know anything about it. Not only that, they are convinced that they never will understand it. In a television interview with the BBC,¹ Robert Oppenheimer put the matter succinctly:

One unfortunate part of the Einstein myth was that what he did was so new, so recondite, so hard to understand, that it was not part of the cultural heritage. Newton was digested and redigested by the century that followed him . . . with Einstein it took the other form. This man is so remarkable, his work is so difficult and so exotic, that we will never know what it's all about. I think that this was an unfortunate contribution to the health of culture and certainly not Einstein's doing. It was the doing of publicists and the doing, I'm afraid, of a hoard of lazy and vulgar scientists who didn't want to bother. Actually Einstein's work was widely understood and widely applied, but there are always those who didn't like it as there are always those who didn't like the painting of Cezanne or the quartets of Beethoven

In this paper I look at the public reportage that appeared in *The Times* (London) and the *New York Times* during the first few weeks after the eclipse observations came out. In both cases the same message emerged: relativity is incomprehensible. Though a good part of the phenomenon was due to a healthy smattering of journalistic sensationalism, it becomes clear that when scientists were called upon to explain to the public what was going on, they failed. Instead, they emphasized the inapplicability of the theory to ordinary experience and the difficulty of the mathematics involved. Mathematics quickly became a smokescreen behind which the scientists hid their own lack of interest or ability to explain the theory to the general public, and the effect was that people believed that an understanding of the theory was only accessible to those who master sophisticated mathematics.

The British reaction

To be fair to the journalists (or publicists as Oppenheimer called them) one must not underestimate the drama of the situation. Though Einsteinian relativity was known in scientific circles as early as the first decade of this century, the general public was introduced to it, all at once, in the fall of 1919. This was not long after the war had ended, and Europe was still reeling in its aftermath. The United States was watching from afar, sending aid to countries



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ravaged by lack of supplies and by political revolutions. When journalists heard that a revolution had occurred in science, they jumped on the story with alacrity and enthusiasm. On Friday, November 7, *The Times* (London) boldly announced:

REVOLUTION IN SCIENCE

New Theory of the Universe

Newtonian Ideas Overthrown

Next to stories about war reparations, political upheavals, and labor disputes, the language was clearly in the right spirit. Newton, the king of science, and British too, had been overthrown. (The political metaphor is obvious and was good copy.)

The article basically gave a balanced report of the joint meeting of the Royal Astronomical Society and the Royal Society held the previous afternoon, in which the results of eclipse observations made by British astronomers on May 29 were announced. The apparent positions of stars near the sun had been shifted in such a way as to confirm the prediction of Einstein's general theory of relativity that light passing near the sun would be bent by the solar gravitational field. The article gave a clear impression that something big had happened in the world of science, but also left room for the possibility that the whole thing might prove to be a false alarm.

Early in the article it is stated that the results "were decisive in the verifying of the prediction of the famous physicist, Einstein" but that "there was difference of opinion as to whether science had to face merely a new and unexplained fact, or to reckon with a theory that would completely revolutionize the accepted fundamentals of physics." And though the president of the Royal Society, Sir J. J. Thompson, is quoted as calling the verified theory "one of the most momentous, if not the most momentous, pronouncements of human thought," he is also reported to have confessed that no one had yet succeeded in stating in clear language what the theory of Einstein really was. Readers are told that three predictions have come out of the theory: the already verified shift of Mercury's perihelion, the newly verified bending of light, and the as yet unverified gravitational redshift. The article concludes that "the question remains open as to whether the verifications prove the theory from which the predictions were deduced."

The next day, Saturday, November 8, sandwiched between an article on the "Food Outlook" and a report on a U.S. decision not to send bunker coal to Europe due to a coal strike, another article on the "revolution in science" appeared.

THE REVOLUTION IN SCIENCE

Einstein v. Newton

Views of Eminent Physicists

From the headlines it is clear that the revolution terminology was considered the best copy, and in fact *The Times* adopted the phrase "revolution in science" as the heading for the majority of their subsequent reporting on the relativity story. In this article, the political element was still prevalent and the opposition between the British Newton and the foreigner Einstein was played up to good advantage. That the British king of science may have in

fact been overthrown was clearly one of the dramatic elements of the story. Even the politicians were worried. In the first paragraph of the article we learn that on the previous day the subject had been "a lively topic of conversation in the House of Commons" and that Sir Joseph Larmor, an M.P. for Cambridge as well as a renowned physicist "had been besieged by inquiries as to whether Newton had been cast down and Cambridge 'done in'." The Einstein versus Newton aspect of the article was capped off nicely by the addition of a letter to the editor by Sir Oliver Lodge in which he cautioned against a hasty rejection of the ether concept and against "a strengthening of great and complicated generalizations concerning space and time . . .," thus establishing himself as the staunch defender of Newton. But what of the strange challenger of Newton's realm? By now many readers were likely wondering, who is this Einstein anyway? On the previous day there had only been a passing reference to "the famous physicist Einstein" — not even his first name had been mentioned! And so *The Times* added a third item to this column on "The Revolution in Science," a short biography of "Dr. Albert Einstein." Readers were informed that the man whose "astronomical discoveries were described . . . as the most remarkable since the discovery of Neptune, and as propounding a new philosophy of the universe, is a Swiss Jew, 45 (sic) years of age." The article goes on to say that he had been professor at Zurich, then Prague, and that afterwards he was nominated a member of the Kaiser Wilhelm Academy for Research in Berlin, "with a salary of 18 000 marks (£900) per annum, and no duties, so that he should be able to devote himself entirely to research work." After this bit of biographical detail which clearly attested to the high esteem that the scientific establishment had for Einstein, the article points out that during the war Einstein "as a man of liberal tendencies," had signed the protest against the German manifesto of the men of science who declared themselves in favor of Germany's part in the war. It also reports that Einstein signed an appeal in favor of the German revolution at the time of the armistice. The article ends saying that he is "an ardent Zionist and keenly interested in the proposed Hebrew University at Jerusalem . . ." Clearly the biographer wanted to emphasize that this man with a German sounding name, living in Berlin, was not really very German. After all, the British astronomers had verified his theory; they were collaborators in the scientific coup d'état against Newton. If Einstein had been German, the postwar mood may have made it seem too much like an intellectual defeat by the enemy.

Einstein was not oblivious to this aspect of the reporting. On November 28th, three weeks after the biography had appeared, *The Times* published a translation of an article that they had solicited from Einstein. Under the bold heading

EINSTEIN ON HIS THEORY

Time, Space and Gravitation

The Newtonian System

by Dr. Albert Einstein, Einstein's article began not with physics, but with politics.

After the lamentable breach in the former international relations existing among men of science, it is with joy and gratefulness that I accept this opportunity of communication with English astronomers

REVOLUTION IN SCIENCE

NEW THEORY OF THE UNIVERSE.

NEWTONIAN IDEAS OVERTHROWN.

Yesterday afternoon in the rooms of the Royal Society, at a joint session of the Royal Astronomical Societies, the results of the observations of the total solar eclipse were discussed.

SIR O. LODGE ON EINSTEIN'S THEORY.

"A TERRIBLE TIME" FOR PHYSICISTS.

Before an interested company, which included a number of physicists and astronomers, Sir Oliver Lodge lectured on Einstein's predictions, at the residence of Lord Glenconner, No. 31, Queen Anne's Gate, Westminster, last night.

Among those present were the Bishop of London, Mr. Hallour, Lord Glenconner, Lord Dunraven, Lord Lytton, Lord Halsdale, Sir Robert Hadfield, Mr. Robert Hudson, Sir Rider Haggard, Francis Younghusband, Sir R. A. Gregory, Mr. Schuster, Mr. H. A. L. Fisher (President of Board of Education), Sir George Bellby, Tennant, Professor Darwin, Professor Eccles, Isaac Downman, Mr. Robert Mond, Sir Archibald Dyson, the Astronomer Royal, which referred to the sun on May 29. (These were the results of the expedition to Brazil to observe the eclipse of September 9.) The subject of conversation in the House of Commons yesterday, and Sir Joseph Larmor, arriving at a lecture before the Royal Astronomical Society last evening, said he had been besieged by inquiries as to whether Newton had been cast down and Cambridge "done in."

Mr. C. Davidson, of Greenwich Observatory, one of the astronomers who took the photographs of the sun's eclipse at Sobral, in Northern Brazil, last May, in conversation with a repre-

terest had been by the time that lamentable test, as astr y acc

THE REVOLUTION IN SCIENCE.

EINSTEIN V. NEWTON.

VIEWS OF EMINENT PHYSICISTS.

Wide interest in popular as well as in scientific circles has been created by the discussion which took place at the rooms of the Royal Society on Thursday afternoon on the results of the expedition to Brazil to observe the eclipse of the sun on May 29. (These were the results of the expedition to Brazil to observe the eclipse of September 9.) The subject of conversation in the House of Commons yesterday, and Sir Joseph Larmor, arriving at a lecture before the Royal Astronomical Society last evening, said he had been besieged by inquiries as to whether Newton had been cast down and Cambridge "done in."

and physicists. It was in accordance with the high and proud tradition of English science that English scientific men should have given their time and labour, and that English institutions should have provided the material means, to test a theory that had been completed and published in the country of their enemies in the midst of war. Although investigation of the influence of the solar gravitational field on rays of light is a purely objective matter, I am nonetheless very glad to express my personal thanks to my English colleagues in this branch of science; for without their aid I should not have obtained proof of the most vital deduction from my theory.

Einstein was obviously using the public interest in his theory to further a cause that was very close to his heart — namely reconciliation between scientists whose countries had so recently been at war with each other. It is revealing to see how Einstein states that the bending of light was the "most vital deduction" from his theory, thus playing up the drama of the British eclipse results. In fact,

many later statements of Einstein show that his whole attitude to the eclipse observations was the reverse: To emphasize that the beauty of his theory was its logical simplicity rather than individual empirical results, Einstein always played down the importance of the eclipse observations in determining the "correctness" of his theory.²

Einstein also responded to the fact that he was described as a Swiss Jew in *The Times* biography. At the conclusion of his article he added a comment which has since become famous, being quoted in many different contexts.

A final comment. The description of me and my circumstances in *The Times* shows an amusing feat of imagination on the part of the writer. By an application of the theory of relativity to the taste of readers, today in Germany I am called a German man of science, and in England I am represented as a Swiss Jew. If I come to be regarded as a *bête noire*, the descriptions will be reversed, and I shall become a Swiss Jew for the Germans and a German man of

science for the English!

The Times responded on the editorial page of the same issue to both of Einstein's remarks.

Dr. Einstein pays a well-intended, if somewhat superfluous, tribute to the impartiality of English science. Our astronomers did not neglect the very rare opportunity afforded by the solar eclipse last May of testing a far-reaching scientific theory, although that theory had been propounded in the country of our enemies during the war.

They then described Einstein's concluding remark, noting that "we concede him his little jest. But we note that, in accordance with the general tenor of his theory, Dr. Einstein does not supply any absolute description of himself." The latter point was as light hearted as the first rebuke was direct. *The Times* was obviously favorably inclined toward Einstein and well aware of his good intentions, but they could not let the unintended slur on British scientists' motivations for research go unanswered.

I quote at length these passages, some of them well known, to emphasize the dramatic atmosphere surrounding the breaking of the news of relativity to the British public. The language so typical in the historical chronicle, of scientific revolutions, new theories overthrowing old ones, and great geniuses of science being honored nationally for their theories, when presented openly in the daily press, acquired an extra political dimension that captured the attention of newspaper readers, and likely colored public responses to the theory. In fact, on November 15th, a week after the news was first reported, a *Times* editorial, announcing the forthcoming translation of the article by Einstein, mentioned "a very large correspondence" which had come in complaining that since "the margin of error in the Newtonian calculations is so minute" and since "near enough" and "almost always" have proved sufficient for practical triumphs in the past why disturb confidence in them now? This was probably in response to statements attributed to scientists that the actual deviations from Newtonian predictions were minute, and that the theory of relativity would have little effect on practical affairs. The *Times* editorial cautioned its readers that in fact "near enough" and "almost always" are not sufficient "when you pass from observation to theory" and, in a rare burst of sensationalism, that "observational science has in fact led back to the purest subjective idealism . . ." The latter assertion clearly added to the fears of the public toward the new-fangled theory, and for some time it was an important issue whether or not a real revolution had indeed taken place, or whether perhaps Newton could in fact be saved.

The American reaction

The first *Times* article had appeared on Friday, November 7, the day after the Royal and Royal Astronomical Societies had met to announce the results of the eclipse expeditions. The news reached America a couple of days later. On Sunday, November 9, the following headline appeared in the *New York Times*:

ECLIPSE SHOWED GRAVITY VARIATION

Diversion of Light Rays Accepted as Affecting
Newton's Principles

HAILED AS EPOCHMAKING

British Scientist Calls the Discovery One of the
Greatest of Human Achievements

The article reports that something unusual and important has just occurred in Britain and that "Dr. Einstein, Professor of Physics in the University of Prague (sic)" has come up with a new theory of space. The general impression given by the article is that the British scientists accept the empirical result and though some are cautious about accepting all the implications of Einstein's theory, the possibility of a major conceptual change in the foundations of physics is generally acknowledged. J. J. Thompson is quoted as saying "A whole continent of new scientific ideas of the greatest importance to some of the most fundamental questions connected with physics" had been discovered, and that "it is the greatest discovery in connection with gravitation since Newton enunciated that principle." This passage was never quoted in the *London Times* reports. Whereas the British seemed to have been more interested in the controversies concerning the validity of the theory, the Americans initially emphasized the acceptance of the theory. Clearly they were less interested in scientific debates, and much more interested in the fantastic. The next day the following headline appeared:

LIGHTS ALL ASKEW IN THE HEAVENS

Men of Science More or Less Agog Over Results of
Eclipse Observations

EINSTEIN THEORY TRIUMPHS

Stars Not Where They Seemed or Were Calculated
to be, but Nobody Need Worry

A BOOK FOR 12 WISE MEN

No More in All the World Could Comprehend it,
Said Einstein When His Daring Publishers
Accepted it

The headlines reveal a certain amount of between-the-lines chuckling at men of science agog over the lights in their orderly heavens being knocked askew by the triumphant Einstein. In the body of the article, unlike in England, there was no indication that any substantial debate among scientists concerning the validity of Einstein's theory might be taking place. Consensual aspects among the scientists were emphasized, and rather than looking to scientific debates for a story, the *New York Times* preferred to present the scientists as a homogeneous group. For them, the story was how the scientists' world had been turned upside down. This made good copy in postwar America, where theory usually took second place to practice, and an anti-intellectual spirit prevailed.³ And whereas in England national pride and a general interest in the goings-on in the world of academia characterized the nature of the news reports, in America the concerns of the general public quickly came to the fore. The opening sentence of the article put the matter succinctly:

Efforts made to put in words intelligible to the non-scientific public the Einstein theory of light proved by the eclipse expedition so far have not been very successful.

The rest of the article basically reported on comments made by various scientists interviewed by the news correspondent. The picture that emerges is one of excited men of science, enthusiastic about the strange new theory, blithely telling the news reporter that he couldn't possibly understand what it's all about, and besides it has little to do with every day life. J. J. Thompson is quoted: after vaguely linking the bending of light with the inference that

light has weight (a distinctly Newtonian attempt at explanation), he assures the reporter that "in a popular sense" the difference between theories of Newton and those of Einstein are infinitesimal, and that "as they are purely mathematical and can only be expressed in strictly scientific terms it is useless to endeavor to detail them for the man in the street." An unnamed astronomer from the eclipse expedition is quoted in the same vein: "Enough has been said to show the importance of Einstein's theory, even if it cannot be expressed clearly in words," laughed this astronomer." And Dr. W. J. S. Lockyer, another astronomer, is quoted as saying that the discoveries, though "very important," did not "affect anything on this earth," and that they "do not personally concern ordinary human beings."

The editorial response was immediate and went straight to the core of the issue. The next day, on Tuesday, November 11, an editorial entitled "Amateurs Will be Resentful" appeared, beginning with this sarcastic statement.

As all common folk are suavely informed by the President of the Royal Society that Dr. Einstein's deductions from the behaviour of light as observed during an eclipse cannot be put in language comprehensible to them, they are under no obligation to worry their heads, already tired by contemplation of so many other hard problems, about this addition to the number.

After referring to Newton and the "story of the apple" with affection, the editorial expresses "uneasiness" at assertions that "while the long-revered law of gravitation remains good enough for everybody except the mathematicians, the latter, for reasons comprehensible only to themselves, now hold it to be not always and everywhere true." The editorial concludes by voicing the suspicion that the "masters" would probably explain more if they could, and that to have them decide in advance for "the rest of us" to give it up is "well, just a little irritating."

Immediately following this editorial is another one entitled "They Have Already a Geometry" in which it is pointed out that "years and years ago" some mathematicians had decided to build a new geometry by assuming that parallel lines do meet, contrary to the assumptions of Euclid, and that if they were alive today they could "apparently" say "We told you so!" due to the "Einstein observations." Obviously referring to the development of non-Euclidean geometry in the 19th century, the editorial maintains a tongue-in-cheek attitude throughout, implying that those early mathematical innovators were just having fun, in sharp contrast to all the scientists who were now taking the "Einstein observations" so seriously. The editorial concludes emphatically by ridiculing the whole business.

It would take the Presidents of at least two royal societies to give plausibility, or even thinkability, to the declaration that as light has weight space has limits. It just doesn't, by definition, and that's the end of that - for common folk, however it may be for higher mathematicians.

Clearly the battle lines had been drawn between mathematical science and the common man. Whereas in England, much of the reporting was couched in terms of a fight between Newton and Einstein or between the tried-and-true and the new-fangled, in America the issue

JAZZ IN SCIENTIFIC WORLD

Prof. Charles Lane Poor of Columbia Explains Prof. Einstein's Astronomical Theories.

A NEW PHYSICS, BASED ON EINSTEIN

Sir Oliver Lodge Says It Will Prevail, and Mathematicians Will Have a Terrible Time.

SPACE OF FOUR DIMENSIONS

In Which Gravity Ceases to be a Force and Becomes a Quality.

ATTEMPT TO MEASURE IT

Its Radius Put at 10,000,000 Light-Years, or 50 Times the Distance to Farthest Star Cluster Known.

ECLIPSE SHOWED GRAVITY VARIATION

Diversions of Light Rays Accepted as Affecting Newton's Principles.

HAILED AS EPOCH-MARKING

British Scientist Calls the Discovery One of the Greatest Human Achievements

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EINSTEIN THEORY TRIUMPHS

Stars Not Where They Seemed or Were Calculated to be, but Nobody Need Worry.

A BOOK FOR 12 WISE MEN

No More in All the World Could Comprehend It, Said Einstein When His Daring Publishers Accepted It.

Special Cable to THE NEW YORK TIMES. LONDON, Nov. 9.—Efforts made to put in words intelligible to the non-scientific public.

was seen as common folk versus scientists, particularly mathematical scientists. The double editorial in the *New York Times* unequivocally threw down the challenge to scientists to explain what was going on, or to shut up.

The differences between the reporting in London and New York are revealing. The former was colored much more by the political events of the day, and debates concerning the validity of the theory appeared in the press very early. Public interest in the story was maintained by the continuing debate. In America, the scientific results were at first taken at face value, and public interest was initially aroused by the fantastic implications of the new theory, and the fact that scientists, the bastions of the intellectual community, were agog at the results. And when it became clear that scientists were not able or willing to explain to the public what the revolution was all about, the issue took on anti-intellectual overtones. It is crystal clear how the seeds of the myth of incomprehensibility were sown in both countries and how, in one form or another, the onus

fell more on scientists to try to explain what the Einstein revolution was all about.

The relativity story continued being reported in both *The Times* and the *New York Times* for months. The next section traces one specific aspect of the reporting in November, and attempts to show how, in the public eye, it contributed to the growing conviction that relativity was impossible to understand. Both stories involve the attempts of scientists to circumvent the new eclipse results by relying on more conventional interpretations. Such attempts died out rather quickly, but as reported in the press, the message they communicated was that even scientists were having difficulty with the new theory, and that the main difficulty was mathematical.

The issue of refraction

One of the immediate reactions from some of the astronomers attending the November 6th joint meeting of the Royal and Royal Astronomical Societies was to express a reticence to accept the full implications of the measurement of the light bending near the sun until they could discount without a doubt the possibility that the light from the stars had been refracted as it passed through the solar atmosphere. *The Times*, in its first article on November 7th, reported that "more than one" speaker had hesitated to accept the Einsteinian interpretation of the results, specifically suggesting the influence of "an unknown solar atmosphere further in its extent than had been supposed and with unknown properties." One of the speakers in favor of this hypothesis was Hugh Frank Newall, a professor of astrophysics at Cambridge and Director of the solar observatory there. Presumably *The Times* correspondent, when interviewing individual scientists after the meeting, had asked them what they thought of Newall's suggestion, since the following day, C. Davidson of Greenwich Observatory was quoted countering the argument. "That is not possible" he was reported to have said, because a solar atmosphere "of a kind unknown to theory and observation" would be required, and because measurements of the speed of comets passing "within grazing distance of the sun" showed no retardation.

The Times seems to have been convinced by this. A week later, on November 15th, in a Saturday editorial under their adopted title "The Revolution in Science," the editors dutifully responded to public interest and summarized the history leading to the eclipse observations. They reported that "Every authority is agreed in the interpretation of the results" and that "Even the most resolute conservative has been unable to suggest substantial ground for the hope that the deflection can be due to any other agency than the gravitation of the sun." On the very next page, however, another article under the same title "Revolution in Science" reported the November meeting of the Royal Astronomical Society. In the true spirit of debate, the article concentrated on Professor Newall's remarks in which he warned his colleagues to consider the possibility of refraction by the outer atmosphere of the sun, the corona, in interpreting the eclipse observations. And two days later, in a letter to the editor, appearing under the usual title, another astronomer, E. Nevill, warned

The recent observations appear to show that light is deflected in passing near to the sun — that is all.

He cautioned that though Einstein's principle predicts such an effect, one cannot conclude the truth of the princi-

ple because other effects may have caused the measured deflection. He suggested as other effects, "tenuous gaseous envelopes to numerous meteorites near the sun, or an extension of the solar corona." His attitude was clearly to exhaust all other possibilities before entertaining the possibility that the foundations of physics must change.

By the end of November the issue was dead. Even Sir Oliver Lodge, who as we will see in Part II emerged in the pages of *The Times* as a scientific spokesman for the position against embracing too quickly all the implications of Einstein's theory, was quoted on the 29th as ruling out "any uninteresting cause such as the existence of a solar atmosphere" to explain the deflection. During the several weeks that the story survived, its treatment in the pages of *The Times* was consistent with the editors' interest in the on-going debate. They reported both sides and eventually the voice of the solar critics faded away, particularly in the face of negative indications of such effects from the study of comets. In the eyes of the public, the issue served to illustrate that there were some scientists who did not want to accept the new theory and though accepting the empirical result, wanted to explain it away in a less revolutionary manner.

In America the coverage of the same issue took an interesting turn which in the end led further to the interpretation that the new theory was esoteric and inaccessible to the lay public. The first articles that appeared, in contrast to *The Times* reportage, underplayed the refraction issue. Whereas in England the existence of dissenting voices within the ranks of the scientists was reported in the first November 7 article, it was not mentioned in the first *New York Times* article at all (November 9), while the second article (November 10) brushed the issue aside with the casual statement that "some cynics suggest that the Einstein theory is only a scientific version of the well-known phenomenon that a coin in a basin of water is not on the spot where it seems to be and ask what is new in the refraction of light." This was in general keeping with the apparent editorial approach of emphasizing the consensual aspects, particularly the acceptance of a major overturning of accepted scientific beliefs, and minimizing the internal debates.

The next day a long article appeared in which American scientists were quoted under the headline "Accepts Einstein Gravitation Theory," with a balancing subheadline "Some Scientists Cautious." Most of the article is composed of lengthy quotes from separate interviews with three scientists, all of whom admitted the revolutionary and confusing aspects of the new theory. The article concludes with a passing reference to "a group of scientific men in New York" who expressed caution as to express an opinion. One of them is quoted as wanting to make sure the bending wasn't due to "refraction of light gases surrounding the sun." However, this appears at the end of a long article, quoting extensively scientists who obviously were taking the news from Europe very seriously. In no sense did a semblance of any real debate appear, as it did in the London *Times*. Interestingly, in this same issue, the double editorial which set up the scientist versus common folk confrontation appeared. Combined with the article in which American scientists accepted the new theory, the emphasis on the scientists as a unified group was reinforced.

The next day a small routine report appeared cover-

ing the November 11 meeting of the National Academy of Sciences.⁴ Buried in the middle of the article is the statement that R. A. Millikan, in a talk on the ultraviolet spectrum, mentioned that Einstein's theory of relativity is not conclusive. Referring to the eclipse observations and the bending of light near the sun, the article reports that "Mr. Millikan showed that such rays may be deflected by refraction of gases around the sun." The editors immediately jumped on this story the next day with an editorial entitled "Sir Isaac Finds a Defender," in which they further developed the point that the real issue was the extent to which the lay person has to defer to the experts in matters of science. Continuing the sarcastic tone of their previous editorials, they reiterate that because "eminent men of science" have deemed the "now almost famous attack of

as to the density and distribution of matter near the sun," but he fails to see how it could "prove the existence of a fourth dimension, or . . . overthrow the fundamental concepts of geometry." The article concludes with a quote in which Poor compares the whole Einstein theory to having tea with the Mad Hatter of Alice in Wonderland fame.

Such statements were strong stuff coming from a Columbia professor, particularly when supported in part by the opinion of Millikan, one of the leading men of the American scientific community. In the same issue, an editorial entitled "Light and Logic" appeared in which the editors denounced the folly of the British scientists, once and for all. Ridiculing British scientists for having been "seized with something like an intellectual panic," the editors remind their readers of J. J. Thompson's earlier

... social unrest and creeping Bolshevism have invaded science ...

Dr. Einstein on the Newtonian law of gravitation" successful, then "it is not for common folk to undertake a defense." However, now it seems the tables have turned and people who might have resented being told that they couldn't possibly understand what's going on "will feel a sort of satisfaction" that "the soundness of the Einstein deduction has been questioned by R. A. Millikan." They tell of Millikan's proposal to account for the bending of light by refraction in the solar atmosphere, concluding that such an explanation "is understandable as well as plausible, and it is hard not to hope that it is true."

Three days later on November 16th the editors were not hoping anymore. They were convinced that the British scientists had bungled the interpretation of the light bending. First of all, one of the American scientists who had previously been interviewed, Charles Lane Poor of Columbia University, now seemed to hold strong views against the Einsteinian interpretation. In an article emblazoned with the title "Jazz in Scientific World," with the misleading subtitle "Prof. Charles Lane Poor of Columbia Explains Prof. Einstein's Astronomical Theories," instead of an explanation we read a quasi-historical interpretation that social unrest and creeping Bolshevism have invaded science leading people to "throw aside the well-tested theories upon which have been built the entire structure of modern science and mechanical development in favor of psychological speculations and fantastic dreams about the universe." The argument is made plausible by referring to a time in 1770 when the mathematician Euler thought he had disproved Newton's law of gravitation and later was proved to be wrong. Poor refutes the relativistic explanation of Mercury's perihelion advance on the grounds that the calculations assume the sun is a sphere when it is not. He refutes the bending of light on the basis of the refraction argument. He acknowledges the measurement as important, in that it "may change some of the hitherto accepted ideas

quoted tribute to Einstein's theory as "perhaps the greatest achievement of human thought." They quote it again saying that it was used by him "in describing to his parishioners" what was in fact, according to other skeptics, merely due to "refraction in passing through gases of different density." And in spite of the fact that articles in *The Times* had systematically been reporting the refraction debate, the editors of the *New York Times* mention that the refraction explanation "seems to have been overlooked in London." The editors had clearly been convinced by Millikan and Poor and the other unnamed American scientists who had expressed caution in accepting the Einstein theory, mentioning refraction as the probable explanation of the eclipse observations. In the remainder of the editorial, the editors take the opportunity to attack many of the notions which people had been discussing since the British astronomers had announced the eclipse results. The picture is created of panicking scientists, particularly astronomers, who "in their first alarm at the prospect of their gravitational universe collapsing about them" declared that "space has its limits, and all straight lines are really curved and come back ultimately to their starting point." The prognosis is that though "these gentlemen may be great astronomers . . . they are sad logicians." An analogy given is that accepting such propositions on the basis of the light bending would be equivalent to admitting that "a theoretical straight line must be curved . . . because a road which appeared as straight on a large-scale map really had a few bends in it." The concept of a four-dimensional universe with time as the fourth dimension is glibly attributed to H. G. Wells and astronomers are accused of thinking that "logic and ontology depend on the shifting views of astronomers." The conclusion is that British astronomers "have regarded their own field as of somewhat greater consequence than it really is."

This editorial was the culmination of a mounting

attack on the scientific intellectuals, fueled by the growing conviction that refraction was the correct explanation of the light bending. It is remarkable that while *The Times* was much more cautious and reported on those who refuted the refraction case as well as those who argued for it, in America there was no indication of a debate at all. Clearly, aside from a quick glance at the press releases coming over from Britain, the American journalists insisted on relying more on their own national community of scientific experts. When Millikan appeared to favor the refraction explanation, and then a Columbia professor, this was too good to be true, and the editors jumped at the chance. However, the denouement came two days later.

On November 18 a double editorial appeared covering the relativity story. The first, entitled "Nobody Need Be Offended" assured readers that "there isn't, really, anything . . . to cause either resentment or humiliation" in the statement that "only twelve people in the world" would be able to understand the best explanation of Einstein's theory. Having been aided "by a reminder from a reader of *The Times* who possesses a well-trained scientific mind," the editors point out that though other subjects can be stated in forms "simpler than would be acceptable to and comprehensible by the experts," with mathematics "the first expression is always as simple and compact as it possibly can be made." "For those who do not understand that expression there is no hope" the reader is told, unless they go through the necessary training. Those unwilling or unable to get such training are advised to "accept the expert's conclusion on the authority of its maker, supported by the acceptance of the few others like him." In Einstein's case, readers are informed, the "few others" number "a minority of twelve."

The about-face is stunning in its abruptness and completeness. Whereas the first editorials complained that the experts were talking down to common folk, and accused scientists of either hiding a lack of comprehension or of being arrogant, now the message was that scientific experts should not be expected to be able to explain things at all. The switch in position revolves around one word: mathematics. The argument was that the lay public's lack of mathematical training blocked them from understanding what Einstein's theory was about. Incomprehensibility was attributed to inaccessibility. And the message was clear that the only recourse available to the public to judge a theory was to defer to the experts. The editorial concluded with what Americans were always capable of understanding, and what has long been a standard policy argument in favor of pure and theoretical science research.

There is usually, or often, one way, however, by which the uncomprehended conclusion of the mathematician can be tested by the uninitiate — they can use it, and if it works when applied in practical matters, then it is at least provisionally true — true to all ordinary intents and purposes.

This pragmatic advice was followed by the editors' sheepish abandonment of the refraction explanation. Under the heading "They Didn't Ignore Refraction," they point out that though it is "the most plausible criticism of the Einstein conclusion" it is "harder to accept than are the very toughest of the Swiss doctor's deductions from his 'principle of relativity.'" Why? Because to believe the refraction explanation would be to assume that Einstein

and other physicists either never heard of refraction or that they forgot to account for it. This would be impossible, the editors claim, for both possibilities "accuse men certainly wise and careful, of ignorance or carelessness." Though, in light of earlier editorials, this might sound facetious, the editorial concludes that

It can safely be assumed that there was something or other about the course of the star rays that proved them to have been deflected, not refracted, and proved it so clearly that no mention of refraction had to be made in the discussion of the subject.

And so the case was closed.

In both England and America, the short-lived refraction debate emphasized that within the scientific community there were those who were resisting the new theory. Equally important was the message that the resistance failed and that the theory must be accepted. Public interest was aroused, and it became increasingly important to try to understand what was going on. In the United States, the refraction issue went a long way in perpetrating the myth of incomprehensibility, specifically because of the episode with Millikan and Poor, and because there was an adversary approach against the British "men of science" in the first place. When the battle was lost, capitulation was complete, and it was conceded that the public did have to defer to the expert after all. And in New York at least, the reason for this was clear — mathematics.

Part II will look at another story reported in the press during the month of November which reinforced the message brought home by the coverage of the refraction debate. The story concerns the physicist Sir Oliver Lodge, and how both *The Times* and the *New York Times* presented him as the personal example of a scientist who first resisted the new theory and then succumbed in confusion to its mathematical difficulty. The discussion will then be extended further, showing how the aura of incomprehensibility continued in the press during the twenties, and looking more closely at the scientific response to relativity in an attempt to decide whether the belief in the incomprehensibility of the theory was purely a product of the press, or whether it was prevalent within the scientific community itself.

References

- a. This paper is an expanded version of a talk given in New York at the annual joint meeting of the American Association of Physics Teachers and the American Physical Society, on January 29, 1979. Part of the research for this paper was conducted while holding a doctoral fellowship from the Social Sciences and Humanities Research Council of Canada.
1. "Albert Einstein: As Seen By His Friends," one-hour television documentary, BBC, 1965.
2. See for example, Carl Seelig, *Albert Einstein: A Documentary Biography* (Staples Press Ltd., London, 1956) p. 162; For an extended discussion of Einstein's attitude see Gerald Holton, "Mach, Einstein, and the Search for Reality," *Daedalus*, 636-673 (Spring, 1968).
3. For a discussion of how scientists tried to develop a niche for pure science in American culture see Ronald C. Tobey, *The American Ideology of National Science, 1919-1930* (University of Pittsburgh Press, 1977); see also Daniel J. Kevles, *The Physicists. The History of a Scientific Community in Modern America* (Alfred A. Knopf, New York, 1978).
4. "Noguchi Tells Discovery," *The New York Times*, November 12, 1919, 16.