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**Max Jammer: Einstein and Religion**

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CHAPTER 1

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*Einstein's Religiosity  
and the  
Role of Religion in  
His Private Life*

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IN HIS autobiography, Einstein wrote that “the essential in the being of a man of my type lies precisely in *what* he thinks and *how* he thinks, not in what he does or suffers.”<sup>1</sup> Had we strictly complied with this statement, we would have had to restrict our discussion on Einstein’s thought about religion and the arguments on which he based his religious belief. But because a religious credo is usually conditioned, partially at least, by the milieu in which one grows up, by the education one receives, and by the literature one has read, we shall begin with an account of these factors insofar as they are relevant to Einstein’s religious outlook.

Official records and Jewish family registers reveal that, since at least 1750, Einstein’s paternal and maternal ancestors had lived in southern Germany, mainly in Buchau, a small town not far from Ulm. Albert’s great-grandfather was born there in 1759, his grandfather Abraham in 1808, and his father Hermann in 1847. The fact that Albert, born in Ulm on March 14, 1879, was, contrary to Jewish tradition, not given the name of his grandfather, shows that his parents were not dogmatic in matters of religion. Although they never renounced their Jewish heritage, they did not observe traditional rites or dietary laws and never attended religious service at the synagogue. Hermann Einstein regarded Jewish rituals as relics of an ancient superstition and “was proud that Jewish rites were not practiced in his home,” as Albert’s son-in-law Rudolf Kayser wrote in his biography of Einstein, which he published under the pseudonym Anton Reiser.<sup>2</sup>

<sup>1</sup> A. Einstein, “Autobiographical Notes,” in *Albert Einstein: Philosopher-Scientist*, ed. P. A. Schilpp (Library of Living Philosophers, Evanston, Ill., 1949), p. 33.

<sup>2</sup> A. Reiser, *Albert Einstein—A Biographical Portrait* (A. and C. Boni, New York, 1930), p. 28.

## CHAPTER 1

In June 1880, Hermann Einstein with his wife Pauline, née Koch, and the infant Albert moved from Ulm to Munich, the capital of Bavaria. Five months later, Maja, Albert's only sibling, was born. When Albert, at age six, entered the Petersschule, a Catholic public primary school (Volksschule), he received religious instruction, which at that time was compulsory in Bavaria. Although his parents were not observant, they hired a distant relative, whose name is not known, to teach Albert the principles of Judaism, obviously to counterpoise the Catholic instruction at school. According to Maja's recollection, it was this relative who awakened in the young Albert a fervent religious sentiment.

He heard about divine will and works pleasing to God, about a way of life pleasing to God—without these teachings having been integrated into a specific dogma. Nevertheless, he was so fervent in his religious feelings that, on his own, he observed religious prescriptions in every detail. For example, he ate no pork. This he did for reasons of conscience, not because his family has set such an example. He remained true to his self-chosen way of life for years. Later religious feeling gave way to philosophical thought, but absolutely strict loyalty to conscience remained a guiding principle.<sup>3</sup>

A somewhat different explanation of young Albert's religious enthusiasm has been given by Alexander Moszkow-

<sup>3</sup> Maja Winteler-Einstein, "Albert Einstein—Beitrag für sein Lebensbild," *The Collected Papers of Albert Einstein* (J. Stachel, ed.), vol. 1 (Princeton University Press, Princeton, N.J., 1987), pp. xlvi-lxvi; "Albert Einstein—A Biographical Sketch" (translated excerpts), English translations of *The Collected Papers of Albert Einstein*, vol. 1 (Princeton University Press, Princeton, N.J., 1987), pp. xv-xxii.

#### RELIGION IN PRIVATE LIFE

ski, who wrote the first biography of Einstein in 1920. Based on personal conversations with Einstein, Moszkowski declared,

His father, who had a sunny, optimistic temperament, and was inclined toward a somewhat aimless existence, at this time moved the seat of the family from Ulm to Munich. They here lived in a modest house in an idyllic situation and surrounded by a garden. The pure joy of Nature entered into the heart of the boy, a feeling that is usually foreign to the youthful inhabitants of cities of dead stone. Nature whispered song to him, and at the coming of the spring-tide infused his being with joy, to which he resigned himself in happy contemplation. A religious undercurrent of feeling made itself manifest in him, and it was strengthened by the elementary stimulus of the scented air, of buds and bushes, to which was added the educational influence of home and school. This was not because ritualistic habits reigned in the family. But it so happened that he learned simultaneously the teachings of the Jewish as well as the Catholic Church; and he had extracted from them that which was common and conducive to a strengthening of faith, and not what conflicted.<sup>4</sup>

In contrast to Maja's report that the private tutor stimulated in Albert religious feelings, Moszkowski claimed that the beauty and splendor of nature opened the gate of the

<sup>4</sup> A. Moszkowski, *Einstein—Einblicke in seine Gedankenwelt, entwickelt aus Gesprächen mit Einstein* (Hoffmann and Campe, Hamburg, 1920); *Einstein the Searcher—His Work Explained from Dialogues with Einstein* (Methuen, London, 1921), p. 221.

## CHAPTER 1

“religious paradise,” as Einstein once called this phase of his youth. Moszkowski pointed out that yet another factor played an important role in Albert’s religious feeling, and that was music. Ever since he took violin lessons at age six, Einstein found music intimately related with religious sentiments.

Signs of his love for music showed themselves very early. He thought out little songs in praise of God, and used to sing them to himself in the pious seclusion that he preserved even with respect to his parents. Music, Nature, and God became intermingled in him in a complex of feeling, a moral unity, the trace of which never vanished, although later the religious factor became extended to a general ethical outlook on the world. At first he clung to a faith free from all doubt, as had been infused into him by the private Jewish instruction at home and the Catholic instruction at school. He read the Bible without feeling the need of examining it critically; he accepted it as a simple moral teaching and found himself little inclined to confirm it by rational arguments as his reading extended very little beyond its circle.<sup>5</sup>

That “Music, Nature, and God became intermingled in him in a complex of feeling” may well serve as a leitmotiv in this study of Einstein’s religiosity. His conception of the relation between Nature and God will engage our attention throughout the discussions. The following episode illustrates how music and God were related in Einstein’s mind.

<sup>5</sup> Moszkowski, *Einstein the Searcher*, p. 222.

#### RELIGION IN PRIVATE LIFE

On April 12, 1930, the Berlin Philharmonic Orchestra, conducted by Bruno Walter, gave a concert in Berlin. The program was Bach, Beethoven, and Brahms, and the soloist was Yehudi Menuhin. At the end of the recital, the audience burst into wild applause, and Einstein rushed over to Menuhin, embraced him, and exclaimed, "Now I know there is a God in heaven!"<sup>6</sup>

Because Moszkowski's book is essentially a report on conversations with Einstein, Einstein's own account of his early religiosity should fully agree with Moszkowski's report. Surprisingly, this is not the case. In his 1949 autobiographical notes, Einstein wrote:

when I was a fairly precocious young man, the nothingness of the hopes and strivings which chases most men restlessly through life came to my consciousness with considerable vitality. Moreover, I soon discovered the cruelty of that chase, which in those years was more carefully covered up by hypocrisy and glittering words than is the case today. By the mere existence of his stomach, everyone was condemned to participate in that chase. Moreover, it was possible to satisfy the stomach by such participation, but not man insofar as he is a thinking and feeling being. As the first way out, there was religion, which is implanted into every child by way of the traditional education machine. Thus I came—despite the fact that I was the son of entirely irreligious (Jewish) parents—to a deep religiosity.<sup>7</sup>

<sup>6</sup> See, e.g., D. Brian, *Einstein—A Life*, p. 193.

<sup>7</sup> A. Einstein, "Autobiographical Notes," in *Albert Einstein: Philosopher-Scientist*, p. 3.

## CHAPTER 1

According to Einstein's recollection, the root of his religiosity, as we see, was neither a love of nature nor music; it was rather his realization of the vanity of human rivalry in the struggle for existence with its concomitant feeling of depression and desperation from which religion seemed to offer a relief. Such an attitude toward life can hardly have been entertained by a young boy, however. It seems, therefore, that Einstein's account is rather a projection of ideas pertaining to his mature age into his youth.

Historical surveys of Munich's educational system and other sources provide some information about the curriculum of Einstein's religious instruction at the Petersschule as well as at the Luitpold Gymnasium, the secondary school in which he enrolled in the beginning of 1888.<sup>8</sup> At the Catholic primary school, he was taught, at age seven, parts of the Small Catechism (*Catechismus Romanus*) and biblical tales of the New Testament; at age eight, sections of the Large Catechism and biblical stories of the Old Testament; and at age nine years, other parts of the Old Testament and the sacraments, baptism, and the Lord's Supper. As the only Jew in his class, Albert seemed never to have felt uncomfortable—with the possible exception of one incident. In one of these lessons, the teacher, a Catholic priest, held up a big nail and reportedly said that "these were the nails with which Christ was crucified by the Jews." According to the biographers, Rudolf Kayser and Carl Seelig, whose report is based mainly on correspondence with Einstein, the teacher intended to stir up hatred against the Jews, and all eyes in

<sup>8</sup> J. Gebele, *Hundert Jahre der Münchener Volksschule* (in German) (C. Gerber, Munich, 1903). Cf. also, Appendix A (Munich Volksschule, Curriculum) and Appendix B (Luitpold Gymnasium, Curriculum) in *The Collected Papers of Albert Einstein*, vol. 1, pp. 341–355.

#### RELIGION IN PRIVATE LIFE

the class turned to Albert who felt very embarrassed.<sup>9</sup> “For the first time Albert experienced the frightful venom of anti-Semitism,” wrote Kayser (Reiser).

A somewhat different account of this episode can be found in Philipp Frank’s biography of Einstein. According to Frank, the teacher said only, “The nails with which Christ was nailed to the cross looked like this,” pointing to the nail he had brought. And Frank explicitly continued:

But he did not add, as sometimes happens, that the Crucifixion was the work of the Jews. Nor did the idea enter the minds of the students that because of this they must change their relations with their classmate Albert. Nevertheless Einstein found this kind of teaching rather uncongenial, but only because it recalled the brutal act connected with it and because he sensed correctly that the vivid portrayal of brutality does not usually intensify any sentiments of antagonism to it but rather awakens latent sadistic tendencies.<sup>10</sup>

Frank’s biography is known to be based largely on epistolary correspondence, whereas Kayser’s account is based on personal conversations with Einstein. In his brief preface to Kayser’s biography, Einstein declared, “I found the facts of the book duly accurate, and its characterization, throughout, as good as might be expected of one who is perforce himself, and who can no more be another than I

<sup>9</sup> A. Reiser, *Albert Einstein—A Biographical Portrait*, p. 30; C. Seelig, *Albert Einstein* (Europa Verlag, Zurich, 1960), p. 16.

<sup>10</sup> P. Frank, *Einstein—His Life and Times* (Knopf, New York, 1947), pp. 9–10.

## CHAPTER 1

can."<sup>11</sup> It is, of course, difficult today to find out which of the two versions is true. It is also difficult to assess how such an anti-Semitic incident, had it really happened, would have affected Albert's religious attitude toward Judaism.

In any case, Albert seemed to have liked these courses and on some occasions even helped his Catholic classmates when they failed to find the correct answer. Nor did he seem to have sensed any difference between what he learned about the Catholic religion at school and about the Jewish religion at home. He learned to respect sincere religious convictions of whatever denomination, an attitude he did not abandon in his later life when he rejected any affiliation with an institutional religious organization.

This attitude is evidenced in his replies to some questions raised by George Sylvester Viereck during a 1929 interview.

"To what extent are you influenced by Christianity?"

"As a child I received instruction both in the Bible and in the Talmud. I am a Jew, but I am enthralled by the luminous figure of the Nazarene."

"Have you read Emil Ludwig's book on Jesus?"

"Emil Ludwig's *Jesus* is shallow. Jesus is too colossal for the pen of phrasemongers, however artful. No man can dispose of Christianity with a *bon mot!*"

"You accept the historical existence of Jesus?"

"Unquestionably! No one can read the Gospels without feeling the actual presence of Jesus. His personality pulsates in every word. No myth is filled with such life."<sup>12</sup>

<sup>11</sup> A. Reiser, *Albert Einstein—A Biographical Portrait*, p. v.

<sup>12</sup> G. S. Viereck, "What Life Means to Einstein," *Saturday Evening*

## RELIGION IN PRIVATE LIFE

The arrangement of religious instruction at the Luitpold Gymnasium differed from that at the Catholic Volksschule in several respects. As an interdenominational school, the Gymnasium offered special courses of religious instruction to its Jewish pupils. In contrast to the three weekly hours at the Petersschule, only two hours per week were devoted to religious studies, and these were given by external teachers especially ordained for this purpose by the Jewish community of the city. Einstein's first teacher was Herr Heinrich Friedmann. In his classes, which were shared by Einstein's Jewish classmates and the Jewish pupils of his next higher grade, Friedmann taught the Ten Commandments, biblical history, selected chapters of the Old Testament, the rituals of the Jewish holy days, and the rudiments of Hebrew grammar. From 1892 to 1895, the year Albert left Munich to join his parents in Italy without having completed his schooling, his teachers of religion were Dr. Joseph Perles, Eugene Meyer, and Dr. Cossmann Werner. They introduced him to the literature of the Psalms, and the history of the Talmud and of the Jews in Spain. Unfortunately, because these external teachers did not enjoy the same authority as their full-time colleagues at the Gymnasium, the attitude of their pupils toward their lessons seems to have been less serious than it should have been. Einstein referred to this in 1929 when he received fiftieth-birthday congratulations from his old teacher Heinrich Friedmann. Einstein declared: "I was deeply moved and delighted by your congratulations. How vividly do I remember those days of my youth in Munich and how deeply do I regret

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*Post*, 26 October 1929; *Schlagschatten, Sechszwanzig Schicksalsfragen an Grosse der Zeit* (Vogt-Schild, Solothurn, 1930), p. 60; *Glimpses of the Great* (Macaulay, New York, 1930), pp. 373–374.

## CHAPTER 1

not having been more diligent in studying the language and literature of our fathers. I read the Bible quite often, but the original text remains inaccessible for me. It certainly was not your fault; you have fought valiantly and energetically against laziness and all kinds of naughtiness.”<sup>13</sup>

Einstein could have added that neither had it been Friedmann’s fault nor the fault of any other of his teachers of religion that, at the age of twelve, just when he should have been preparing for the bar mitzvah, the Jewish confirmation, he suddenly became completely irreligious. Ironically, this conversion was, indirectly at least, the consequence of the only religious custom that his parents observed, namely to host a poor Jewish student for a weekly meal. The beneficiary was Max Talmud, a medical student from Poland, ten years older than Albert. In spite of their age difference, Albert and Talmud became intimate friends, and this friendship changed Albert’s attitude toward religion. Because Talmud (or Talmey, as he called himself later when working as a general practitioner in New York) wrote a book on relativity in which he described his visits to the Einsteins in Munich, we have an authentic account of the influence he exerted on Albert.<sup>14</sup> He directed Albert’s attention to Aaron Bernstein’s popular

<sup>13</sup> “Ihre Gratulation hat mich gerührt and gefreut. Wie lebhaft sind mir die Münchener Jugendtage aus der Vergangenheit aufgestiegen und wie oft habe ich es bedauert, nicht fleissiger gewesen zu sein im Studium der Sprache und Literatur unserer Väter. Oft lese ich in der Bibel, aber der Urtext ist mir unzugänglich geblieben. Ihre Schuld ist es wahrlich nicht; Sie haben wacker und energisch gegen Faulheit und Allotria gekämpft.” Einstein Archive, reel 30-403.

<sup>14</sup> M. Talmey, *The Relativity Theory Simplified* (Falcon Press, New York, 1932).

## RELIGION IN PRIVATE LIFE

*Naturwissenschaftliche Volksbücher* (Popular Books on Physical Science), Ludwig Büchner's materialistic *Kraft und Stoff* (Force and Matter), Immanuel Kant's *Kritik der Reinen Vernunft* (Critique of Pure Reason) as well as to various books on geometry and other branches of mathematics. Einstein himself summed up the results of Talmey's influence:

Through the reading of popular scientific books I soon reached the conviction that much in the stories of the Bible could not be true. The consequence was a positively fanatic [orgy of] freethinking coupled with the impression that youth is intentionally being deceived by the state through lies; it was a crushing impression. Suspicion against every kind of authority grew out of this experience, a skeptical attitude towards the convictions which were alive in any specific social environment—an attitude which has never again left me, even though later on, because of a better insight into the causal connections, it lost some of its original poignancy.<sup>15</sup>

An immediate consequence of this change of mind was the fact that Einstein refused to become bar mitzvahed.<sup>16</sup> Although this ceremonious act, introduced in the thirteenth century, is not a "halachist" (necessary) condition for membership in the Jewish community, even liberal Jews regard it as a precept that must be obeyed. By not complying with it, Einstein obviously intended to demonstrate his personal independence from the dictates of traditional authority. The

<sup>15</sup> A. Einstein, "Autobiographical Notes," in *Albert Einstein: Philosopher-Scientist*, p. 5.

<sup>16</sup> A. Pais, *Subtle is the Lord . . . The Science and the Life of Albert Einstein* (Oxford University Press, Oxford, 1982), p. 38.

## CHAPTER 1

nonperformance of his bar mitzvah would have caused serious political problems, at least on the part of the orthodox, had Einstein accepted David Ben-Gurion's offer in November 1952 to become the second president of the State of Israel after the death of Chaim Weizmann.

Interestingly, when he was living in Berlin, Einstein did own a pair of phylacteries (tephillin). Needless to say, Einstein never performed the ritual of putting them on as religious Jews used to do after becoming bar mitzvah. He kept them obviously only as an heirloom or memento of his ancestors. In May 1933, four months after Einstein had left Germany, his apartment on Haberlandstrasse 5 was raided by the Gestapo under the pretext of searching for anti-German propaganda literature, and these phylacteries and a prayer book, together with valuable pictures and cutlery, were looted.<sup>17</sup>

Einstein's indifference concerning religious affiliations is also shown by the fact that his first wife Mileva Maric, a fellow student at the Polytechnic in Zurich, belonged to the Greek Orthodox Church. Their marriage took place in Zurich in 1903 and was a civil ceremony without the presence of a rabbi or a priest. Both sets of parents had strongly opposed the marriage, mostly because of the difference in their religious backgrounds. After their two sons, Hans Albert and Eduard, were born, questions arose regarding their religious instruction and therefore their elementary school education.<sup>18</sup> Einstein reportedly said, "Anyway, I dislike very

<sup>17</sup> For details, see A. Hermann, *Einstein—Der Weltweise und sein Jahrhundert* (Piper, Munich, 1994), p. 410.

<sup>18</sup> The existence of their illegitimate daughter Lieserl, born in 1902 and apparently left with Mileva's relatives, became generally known only in 1987. In spite of careful research, no details about her fate are

## RELIGION IN PRIVATE LIFE

much that my children should be taught something that is contrary to all scientific thinking.”<sup>19</sup>

As far as we know, Einstein never attended religious service and never prayed in a synagogue or at any other place of worship. He visited such places only to participate in social events. The following examples illustrate this fact. On January 29, 1930, he participated at a Welfare Concert for the benefit of the Youth Department of the Jewish Community, which took place in Berlin’s “Neue Synagoge” located at 30 Oranienburger Strasse. The program included arias sung by the famous tenor Hermann Jadlowker and the Adagio in B-minor for two violins by Johann Sebastian Bach, played by Einstein and the violist Alfred Lewandowski.<sup>20</sup> Early in March 1933, at the end of his second visit to the United States, Einstein became the godfather of Albert, the eight-day-old son of Jacob Landau, the director of the Jewish Telegraphic Agency, at a ceremony in a New York synagogue. During the last two decades of his life, Einstein participated once every two or three years at the discussions that concluded the Friday evening service for Jewish students at Princeton University.

Einstein’s last wish was not to be buried in the Jewish tradition, but to be cremated and his ashes scattered, indicating that he disregarded religious rituals until his death on 18 April 1955.

In the late 1940s, reminiscing about his juvenile religious

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available. Cf., e.g., R. Highfield and P. Carter, *Private Lives of Albert Einstein*.

<sup>19</sup> P. Frank, *Einstein—His Life and Times*, p. 280.

<sup>20</sup> A photo that shows Einstein on this occasion, playing the violin and wearing a skullcap—as Jews usually do in a synagogue—can be found in W. Cahn, *Einstein—A Pictorial Biography* (Citadel Press, New York, 1955), p. 62.

## CHAPTER 1

fervor, Einstein offered a philosophical explanation of his estrangement from traditional religion.

It is quite clear to me that the religious paradise of youth, which was thus lost, was a first attempt to free myself from the chains of the “merely personal,” from an existence which is dominated by wishes, hopes, and primitive feelings. Out yonder there was this huge world, which exists independently of us human beings and which stands before us like a great, eternal riddle, at least partially accessible to our inspection and thinking. The contemplation of this world beckoned like a liberation, and I soon noticed that many a man whom I had learned to esteem and to admire had found inner freedom and security in devoted occupation with it. The mental grasp of this extrapersonal world within the frame of the given possibilities swam as [the] highest aim half consciously and half unconsciously before my mind’s eye. Similar motivated men of the present and of the past, as well as the insights which they had achieved, were the friends which could not be lost. The road to this paradise was not as comfortable and alluring as the road to the religious paradise; but it has proved itself as trustworthy, and I have never regretted having chosen it.<sup>21</sup>

Interestingly, Einstein’s account does not mention the role that Max Talmey had played in this context. Nor does it describe the emotional struggle and the conscientious conflict that the young Einstein must have experienced

<sup>21</sup>A. Einstein, “Autobiographical Notes,” in *Albert Einstein: Philosopher-Scientist*, p. 5.

#### RELIGION IN PRIVATE LIFE

when he began to doubt the veracity of the Bible. Some biographers see in his religious skepticism the source of his freedom of thought and intellectual independence in scientific reasoning and even regard it as a necessary condition for his discovery of the theory of relativity. Thus, for example, Banesh Hoffmann, who in the thirties had worked on this theory with Einstein for some time and who called Einstein a “creator and rebel,” regarded Einstein’s “anti-religious” stance as the cause of his suspicion of authority. After quoting Einstein’s own statement that “to punish me for my contempt for authority, Fate made me an authority myself,” Hoffmann declared, “His early suspicion of authority, which never wholly left him, was to prove of decisive importance. For without it, he would not have been able to develop the powerful independence of mind that gave him the courage to challenge established scientific beliefs and thereby revolutionize physics.”<sup>22</sup>

Einstein’s defiance of authority explains his well-known aversion to social conventions, his nonconformity in apparel and attire, his bohemian style of life during his student years in Zurich, and his friendship and solidarity with colleagues like the Austrian socialist Friedrich Adler or the members of the “Olympia Academy” in Berne, Maurice Solovine, Conrad Habicht, and Michele Angelo Besso. For all of them, the ideologies of Marx and Mach replaced the religion of the Bible. Some authors assign these ideological influences a crucial role in Einstein’s intellectual development and regard them, in particular, as the driving force for his creation of the theory of relativity. For example, the sociologist Lewis Samuel Feuer, who in his

<sup>22</sup> B. Hoffmann, with the collaboration of Helen Dukas, *Albert Einstein—Creator and Rebel* (Viking Press, New York, 1972), p. 24.

## CHAPTER 1

youth experienced a similar estrangement from religion—though in the different milieu of New York City’s Lower East Side—offered his view of how sociopolitical ideas inspired Einstein’s theorizing in physics.<sup>23</sup>

Imagine the youthful genius Einstein in the Zurich setting of a radical student group in which the revolutionary ideas of Marx commingle with those of Mach. Einstein imbibes a notion of the relativity of social laws to transient social systems; the laws of contemporary society are in reality the expressions of bourgeois relations, and are not immutable absolutes. In the evenings, he and Fritz Adler, we may surmise, would argue whether bourgeois observers and socialist ones could describe a common social world, or whether the described social events varied with the social standpoint of the observer; for this too was an issue that Austro-Marxist philosophers debated endlessly. How would this Marxist revolutionary emotion and vision be expressed, though in a sublimated, transfigured form, in the mind of a young “revolutionary genius” in physics? The emotions that gave rise to sociological relativity might then seek to express themselves in a physical relativity; transposed and projected upon the study of the physical world, they would issue in an overthrow of absolute space and time, and in a conception of the relativity of length and time measurements to the observer’s state of motion.<sup>24</sup>

<sup>23</sup> L. S. Feuer, “A Narrative of Personal Events and Ideas,” in S. Hook, W. L. O’Neill, and R. O’Toole, eds., *Philosophy, History and Social Action* (Kluwer, Dordrecht, 1988), pp. 1–85.

<sup>24</sup> L. S. Feuer, “The Social Roots of Einstein’s Theory of Relativity,” *Annals of Science* 27 (1971): 277–298, 313–344.

## RELIGION IN PRIVATE LIFE

In short, “the emotional standpoint of the Zurich-Berne revolutionary students circle provided the supporting social environment, motivation, and modes of thought for the conception of the theory of relativity.”<sup>25</sup> Had Einstein’s theory of relativity really been the outcome of such discussions with revolutionary friends, had his congeniality with them been the result of his bohemian style of life and his rejection of authority, and the latter, in turn, the result of his abandonment of his “religious paradise,” then, bringing this chain of consequences to its logical conclusion, one would be tempted to contend that what has been called “one of the greatest, perhaps the greatest, of achievements in the history of human thought” had its ultimate *fons et origo* in an estrangement from religion.<sup>26</sup>

Such a conclusion seems to support the thesis that science and religion are irreconcilable antagonists. But Einstein never conceived of the relation between science and religion as an antithesis. On the contrary, he regarded science and religion as complementary to each other or rather as mutually depending on each other, a relation that he described by the metaphor quoted above, “Science without religion is lame, religion without science is blind.”<sup>27</sup>

<sup>25</sup> L. S. Feuer, *Einstein and the Generations of Science* (Basic Books, New York, 1974), p. 66.

<sup>26</sup> This laudatory statement was made by Sir Joseph John Thomson, president of the Royal Society of London, on 6 November 1919, when the Fellows of the Royal Society and of the Royal Astronomical Society convened in Burlington House and heard that the British solar eclipse expedition confirmed Einstein’s prediction of the deflection of light in a gravitational field. See *New York Times*, 9 November 1919.

<sup>27</sup> A. Einstein, “Science and Religion,” Address at the Conference on Science, Philosophy, and Religion, New York, 1940; reprinted in A. Einstein, *Ideas and Opinions* (Crown, New York, 1954, 1982), pp. 44–49. Quotation on p. 46.

## CHAPTER 1

In 1930, when interviewed by the Irish writer James Murphy and the Irish mathematician John William Navin Sullivan, Einstein emphatically declared, “I am of the opinion that all the finer speculations in the realm of science spring from a deep religious feeling, and that without such feeling they would not be fruitful.”<sup>28</sup>

If, in Einstein’s opinion, science and religion are complementary, two questions arise. First, how could he disapprove of religious instruction for his sons on the grounds that it is “contrary to all scientific thinking”?<sup>29</sup> If we exclude the possibility that he changed his mind, then the apparent contradiction can be resolved by recognizing that he used the term “religion” or “religious” in two different senses. In the expression “religious instruction,” he used it in the sense of instruction in accordance with a denominational tradition characterized by the rituals of a specific community, whereas in the expression “science without religion,” “religion” referred to a pious sentiment of an inspired devotion without any dogmatic indoctrination.<sup>30</sup>

The second question asks whether the thesis—proposed by Feuer, Hoffmann, and others—that Einstein’s discovery of the theory of relativity presupposed disrespect of authority and ultimately of religion can be maintained in view of its evident contradiction with Einstein’s concept of the relation between science and religion. Some proponents of this thesis regard the very name “theory of relativity” as an argument in support of their point of view,

<sup>28</sup> A. Einstein, “Science and God,” *Forum and Century* 83 (1930): 373–379.

<sup>29</sup> P. Frank, *Einstein—His Life and Times*, p. 280.

<sup>30</sup> More precise explications of the term “religion” in its various connotations will engage our attention in chapter 2, which deals with Einstein’s writings on the philosophy of religion.

#### RELIGION IN PRIVATE LIFE

because, they claim, the term “relativity” connotes some latitude or freedom as opposed to absoluteness and therefore invalidates the “absolute sacrosanctity of a religious dogma.” “The word ‘relativity,’ and the expression ‘the principle of relativity,’” wrote Feuer, “became emotional symbols of the new generational mode of thought, symbols for the iso-emotional line of generational rebellion.”<sup>31</sup> Some may object that the word “relativity” in such interpretations is confused with the term “relativism,” which indeed is widely used to denote the denial of the objectivity or absoluteness of ethical or religious values. The philosopher and historian of culture Ernst Cassirer admonished us not to regard the theory of relativity as “a confirmation of the Protagorean doctrine that man is the ‘measure of all things.’” He added, “The physical theory of relativity teaches not that what appears to each person is true to him, but, on the contrary, it warns against appearances, which hold only from a particular system.”<sup>32</sup>

Moreover, mathematician Felix Klein and physicist Arnold Sommerfeld suggested that the name “theory of relativity” should be replaced by “theory of invariants” because the theory is merely a theory of the invariants of the Lorentz transformation or, in the case of general relativity, of a more general transformation. “The term ‘theory of relativity’ is an unfortunate choice,” wrote Sommerfeld, “its essence is not the relativity of space and time but rather

<sup>31</sup> L. S. Feuer, “The Social Roots of Einstein’s Theory,” p. 320. “One idea is iso-emotional with another, or with any cultural manifestation, when it is an expression, reflection, outcome, or projection of the same sort of emotion.” *Ibid.*, p. 315.

<sup>32</sup> E. Cassirer, *Substance and Function—Einstein’s Theory of Relativity* (Open Court, London, 1963), p. 392.

## CHAPTER 1

the independence of the laws of nature from the viewpoint of the observer. The bad name has misled the public to believe that the theory involves a relativity of ethical conceptions, somehow like Nietzsche's *Beyond Good and Evil*.<sup>33</sup>

In fact Einstein never made these associations with relativity, nor was he the first to use the term relativity in physics. The adjective "relative" (Latin: *relativus*) has, of course, a history reaching back to antiquity. Newton applied it in the first Scholium of his *Principia* when he distinguished between *tempus absolutum* and *tempus relativum*, *spatium absolutum* and *spatium relativum*, and *motus absolutus* and *motus relativus*. But the noun "relativity" or its equivalent in other languages was first used in the nineteenth century by poets, such as Samuel Taylor Coleridge, and by philosophers, such as John Stuart Mill, mostly in the expression "relativity of knowledge." Einstein probably encountered this term for the first time when as a student he read the first volume of Jules Violle's *Lehrbuch der Physik* (1892) and Henri Poincaré's *La Science et Hypothèse* (1902), in which the term "le principe de la relativité" denotes the statement that "the motion of an arbitrary system must obey the same laws, whether referred to fixed axes or to moving axes undergoing a uniform rectilinear motion." Clearly, Poincaré, in every respect a conservative, can hardly be assumed to have linked any ideological connotation with this term.<sup>34</sup>

Einstein himself once emphasized, "In the relativity the-

<sup>33</sup> A. Sommerfeld, "Philosophie und Physik seit 1900," *Naturwissenschaftliche Rundschau* 1 (1948): 97–100; *Gesammelte Schriften* (Vieweg, Braunschweig, 1968), vol. 4, pp. 640–643.

<sup>34</sup> For details on the use of this term, see *The Collected Papers of Albert Einstein* (Princeton University Press, Princeton, N.J., 1989), vol. 2, p. 259.

#### RELIGION IN PRIVATE LIFE

ory, it is no question of a revolutionary act but of a natural development of lines which have been followed for centuries."<sup>35</sup> On another occasion he declared that this theory "grew out of the Maxwell-Lorentzian electromagnetics as a surprisingly simple summary and generalization of previously independent hypotheses."<sup>36</sup> Obviously, a "simple summary and generalization" of previous ideas has nothing to do with a revolt against authority or religion.

Einstein himself repeatedly insisted that his theory of relativity should not be regarded as a revolutionary break with the past. Thus, on April 2, 1921, when he arrived in New York on his first visit to the United States and was interviewed by reporters of the *New York Times*, Einstein declared, "There has been a false opinion widely spread among the general public that the theory of relativity is to be taken as differing radically from the previous developments in physics. . . . The men who have laid the foundations of physics on which I have been able to construct my theory are Galileo, Newton, Maxwell, and Lorentz."<sup>37</sup> He often called his theory "simply a systematic development of the electrodynamics of Maxwell and Lorentz," and regarded it as an "evolution," not a revolution, of the science of dynamics.<sup>38</sup>

<sup>35</sup> C. Seelig, *Albert Einstein—A Documentary Biography* (Staples Press, London, 1956), p. 82.

<sup>36</sup> A. Einstein, *Über die spezielle und die allgemeine Relativitätstheorie* (Vieweg, Braunschweig, 1920), p. 28.

<sup>37</sup> *New York Times*, 4 April 1921. Also quoted in G. Holton, "Einstein's search for the Weltbild," *Proceedings of the American Philosophical Society* 125 (1981): 1–15.

<sup>38</sup> A. Einstein, "What is the theory of relativity?" *London Times*, 28 November 1919; reprinted in A. Einstein, *Ideas and Opinions* (Crown Publishers, New York, 1954, 1982), pp. 227–232; p. 248.

## CHAPTER 1

A valuable but little known source of information on Einstein's way of thinking is the diary of Count Harry Kessler, a prominent diplomat, art connoisseur, litterateur, and socialite of Berlin's intellectual circles in the twenties. Because he wrote everything down immediately after it had happened, the records in his diary are highly reliable. Kessler met frequently with Einstein at receptions, dinners, and other occasions. At a reception given by the Einsteins on March 20, 1922, the discussion veered to the theory of relativity and the question of how far it differs from classical theories in physics. "It is the inextricable connection between matter, space, and time that is new in the theory," said Einstein. And Kessler's entry in his diary continues:

What he does not understand is why people have become so excited about it. When Copernicus dethroned the earth from its position as the focal point of creation, the excitement was understandable because a revolution in all man's ideas did occur. But what change does his own theory produce in humanity's view of things? It is a theory which harmonizes with every reasonable outlook or philosophy and does not interfere with anybody being an idealist or materialist, pragmatist, or whatever else he likes.<sup>39</sup>

In his profound study of the conceptual development of the theory of relativity, Gerald Holton not only confirms Einstein's judgment of the nonrevolutionary character of the theory, he even regards it as an example of the general rule that a "so-called scientific 'revolution' turns out to be

<sup>39</sup> Harry Graf Kessler, *Tagebücher 1918–1937* (Insel Verlag, Frankfurt, 1961); *The Diary of a Cosmopolitan* (Weidenfeld and Nicolson, London, 1971), p. 157.

## RELIGION IN PRIVATE LIFE

at bottom an effort to return to a classical purity."<sup>40</sup> This is, of course, the very antithesis of the thesis of Feuer and Hoffmann, which has also been rejected by John L. Heilbron in his review of Feuer's book.<sup>41</sup> Paul Forman, who is well-known for his studies on the sociopolitical conditions of the development of modern physics, came to the conclusion that "it would be a mistake to claim that Einstein and his close friends belonged to an alternative culture. They were not science-oriented bohemians, nor were they social revolutionaries."<sup>42</sup>

In any case, there can be little doubt that the predominant motivations that led Einstein to his development of the theory of relativity were purely physical considerations, like his recognition that Maxwell's electrodynamics, as understood at the beginning of the century, "when applied to moving bodies, leads to asymmetries which do not appear to be inherent in the phenomena,"<sup>43</sup> or his sudden realization that the important concept of simultaneity must be defined in terms of physical operations.<sup>44</sup> Einstein was

<sup>40</sup> G. Holton, "On the origins of the special theory of relativity," *American Journal of Physics* 28 (1960): 627-636; reprinted in G. Holton, *Thematic Origins of Scientific Thought: Kepler to Einstein* (Harvard University Press, Cambridge, Mass., 1973), pp. 165-183.

<sup>41</sup> J. L. Heilbron, book review, *Science* 185 (1974): 777-779.

<sup>42</sup> P. Forman, Introduction to L. Infeld, *Why I Left Canada: Reflections on Science and Politics* (McGill-Queen's University Press, Montreal, 1978), p. 9.

<sup>43</sup> A. Einstein, "Zur Elektrodynamik bewegter Körper," *Annalen der Physik* 17 (1905): 891-921; H. A. Lorentz, A. Einstein, H. Minkowski, and H. Weyl, *The Principle of Relativity* (Dover, New York, 1952), pp. 35-65; *The Collected Papers of Albert Einstein*, vol. 2 (Princeton University Press, Princeton, N.J., 1989), pp. 276-306.

<sup>44</sup> "An analysis of the concept of time was my solution." A. Einstein, "How I created the theory of relativity," lecture given in Kyoto, 14 December 1922. *Physics Today* 35 (August 1982): 45-47.

## CHAPTER 1

fully aware, however, that the construction of a new far-reaching theory, even if motivated by purely physical considerations, is not an instantaneous mental process. Thus, he began his Kyoto lecture, in which he described the impact of his analysis of time, with the declaration: "It is not easy to talk about how I reached the idea of the theory of relativity; there were so many hidden complexities to motivate my thought, and the impact of each thought was different at different stages in the development of the idea. I will not mention them all here." In a later statement, he recalled the above-mentioned symmetry problem and said, "What led me more or less directly to the special theory of relativity was the conviction that the electromagnetic force acting on a body in motion in a magnetic field was nothing but an electric field." He immediately added, "There is, of course, no logical way leading to the establishment of a theory but only groping constructive attempts by careful considerations of factual knowledge."<sup>45</sup>

In referring to "hidden complexities" or "groping constructive attempts," was Einstein alluding to the possibility that extraphysical considerations had been involved? As shown below, if there had been such extraphysical ingredients in Einstein's construction of his theory of relativity they could not have been sociological or political, as has been contended by Feuer, for example, but they could only have been philosophical or, perhaps, religious, in the sense of Einstein's definition of this term.

<sup>45</sup> Statement sent to a special meeting of the Cleveland Physical Society, 19 December 1952, honoring the centenary of Michelson's birth; printed in R. S. Shankland, "Michelson-Morley Experiment," *American Journal of Physics* 32 (1964): 16–35.

#### RELIGION IN PRIVATE LIFE

The exact formulation of Einstein's definition of religion is, of course, part of his philosophy of religion and will be considered in chapter 2. At present it suffices to know what he meant by "being religious." In his diary, Count Kessler tells of a dinner that took place at publisher Samuel Fischer's home in Berlin February 14, 1927. Apart from Einstein and Kessler, the famous novelist Gerhart Hauptmann and the well-known Berlin critic Alfred Kerr were guests. Pretending to be a firm believer in astrology, Hauptmann asked Einstein whether he shared this belief. Einstein, who had just read Lucien Levy-Bruhl's book *Die geistige Welt der Primitiven* about the demonology of early cultural levels and its effects on ancient religious beliefs, told Hauptmann that faith in astrology evolved from an ancient belief in demons. Einstein, who did not believe in such supernatural beings, strongly condemned astrology as a superstition.

The conversation then turned from astrology to religion. "Kerr," Kessler reported,

constantly interrupted with facetious remarks . . . the subject of God was a special butt for his derision. I tried to silence him and said that, since Einstein is very religious, he should not needlessly hurt his feelings. "What?" exclaimed Kerr, "It isn't possible! I must ask him right away. Professor! I hear that you are supposed to be deeply religious?" Calmly and with great dignity, Einstein replied, "Yes, you can call it that. Try and penetrate with our limited means the secrets of nature and you will find that, behind all the discernible concatenations, there remains something subtle, intangible and inexplicable. Veneration for this force

## CHAPTER 1

beyond anything that we can comprehend is my religion. To that extent I am, in point of fact, religious."<sup>46</sup>

LET US now discuss briefly the philosophical background of Einstein's scientific work or, more precisely, how far philosophy has influenced his physics and, inversely, how far his achievements in physics have affected his philosophical outlook. Both issues are closely interrelated.<sup>47</sup> Einstein himself was aware of this interdependence when he wrote to Cornelius Lanczos, "I began with a skeptical empiricism more or less like that of Mach. But the problem of gravitation converted me into a believing rationalist, that is, into someone who searches for the only reliable source of Truth in mathematical simplicity."<sup>48</sup>

By "the problem of gravitation," he meant the general theory of gravitation. He explained his initial endorsement of "skeptical empiricism," according to which no knowledge with existential reference is possible independent of experience, as the result of having read the writings of Hume and of Mach. He acknowledged repeatedly that the empiricism of Hume and Mach had deeply influenced his early work on relativity. Thus, he wrote to Carl Seelig, "The critical thought necessary for the discovery of this central point [i.e., the recognition of the need for an operational definition of the concept of distant simultaneity] was

<sup>46</sup> H. G. Kessler, *The Diary of a Cosmopolitan*, p. 322.

<sup>47</sup> The second issue will be discussed in general—i.e., without being restricted to Einstein personally—in chapter 3, because it touches on the implications of Einstein's theories for religious thought.

<sup>48</sup> Einstein to C. Lanczos, 24 January 1938. Einstein Archive, reel 15-267.

#### RELIGION IN PRIVATE LIFE

afforded me decisively by the reading of David Hume's and Ernst Mach's philosophical writings." On another occasion, he declared that he had studied Hume's *Treatise of Human Nature* "with fervor and admiration shortly before the discovery of the theory of relativity." "It is very well possible," he added, "that without these philosophical studies I would not have arrived at the special theory of relativity."<sup>49</sup>

Incidentally, Einstein's statement sharply contradicts David Hilbert's explanation of how Einstein discovered relativity. Hilbert, the eminent Goettingen mathematician who preceded Einstein by five days in presenting the famous field equations of general relativity, once asked a gathering of mathematicians, "Do you know why Einstein said the most original and profound things about space and time that have been said in our generation? Because he had learned nothing about all the philosophy and mathematics of time and space."<sup>50</sup>

Hilbert's explanation is also contradicted by Max Talmey's statement that a teenage Einstein had studied Immanuel Kant's *Critique of Pure Reason*.<sup>51</sup> As is well known, Kant claimed to have proved that space and time do not subsist as entities in themselves but are rather a priori forms of intuition and, as such, preconditions for the possibility of experience. Einstein's work in physics convinced him that Kant's differentiation between a priori and a pos-

<sup>49</sup> C. Seelig, *Albert Einstein—A Documentary Bibliography*, p. 67.

<sup>50</sup> P. Frank, *Einstein—His Life and Times*, p. 206.

<sup>51</sup> M. Talmey, *The Relativity Theory Simplified*. See also C. Seelig, *Albert Einstein*, p. 14, where it is stated that "the 16-year-old youth intoxicated himself with Kant's *Critique of Pure Reason*."

## CHAPTER 1

teriori or empirical notions “is erroneous, i.e., does not do justice to the problem in a natural way. All concepts, even those which are closest to experience, are from the point of view of logic freely chosen conventions, just as is the case with the concept of causality, with which this problematic concerned itself in the first instance.”<sup>52</sup>

In a letter to Max Born in 1918, Einstein wrote: “Once you concede to him [Kant] merely the existence of synthetic a priori judgements, you are trapped. I have to water down the ‘a priori’ to ‘conventional,’ so as not to have to contradict him, but even then the details do not fit. Anyway it is very nice to read, even if it is not as good as his predecessor Hume’s work. Hume also had a far sounder instinct.”<sup>53</sup> Still, there were issues on which Einstein agreed with Kant. Referring to the fact that the totality of our sense experiences can be put in order by means of thinking, a fact “which leaves us in awe, but which we shall never understand,” Einstein said that “the eternal mystery of the world is its comprehensibility.” He declared, “It is one of the great realizations of Immanuel Kant that the setting up of a real external world would be senseless without this comprehensibility.”<sup>54</sup>

Talmey’s comment that “Kant became Albert’s favorite philosopher after he had read through his *Critique of Pure Reason* and the work of other philosophers,” if correct at all, could have referred only to the young Einstein. By 1920 at

<sup>52</sup> P. A. Schilpp, ed., *Albert Einstein: Philosopher-Scientist*, p. 13.

<sup>53</sup> *The Born-Einstein Letters* (Macmillan, London, 1971), p. 7.

<sup>54</sup> A. Einstein, “Physics and Reality,” *Journal of the Franklin Institute* 221 (1936): 349–382; reprinted in *Out of My Later Years* (Littlefield, Adams & Co., Totowa, N.J., 1967), pp. 58–94.

#### RELIGION IN PRIVATE LIFE

least, the philosopher whom Einstein admired most was Baruch (later, Benedictus) Spinoza, the seventeenth-century Jewish philosopher, who was excommunicated by the Amsterdam synagogue and declined the Heidelberg professorship in order to live as a lens grinder, leading an independent life dedicated to philosophical reflections. Einstein already had studied Spinoza's *Ethics* in Berne with his friends of the Olympia Academy and resumed this study several years later.<sup>55</sup> His earliest recorded references to Spinoza date from 1920. In that year he composed a poem entitled "Zu Spinozas Ethik" (see the appendix for the entire poem in the original German). It begins with the following words,

How much do I love that noble man  
More than I could tell with words  
I fear though he'll remain alone  
With a holy halo of his own.

Some background may be helpful so that the reader not conversant with Spinoza's philosophy can understand to what extent Einstein concurred with him. Rejecting the traditional theistic concept of God, Spinoza denied the existence of a cosmic purpose on the grounds that all events in nature occur according to immutable laws of cause and effect. The universe is governed by a mechanical or mathematical order and not according to purposeful or moral intentions. Though he employed the notion of "God," Spinoza applied it only to the structure of the impersonal cosmic order and declared

<sup>55</sup> Einstein apparently used the German translation of Spinoza's *Ethica ordine geometrico demonstrata*, published by F. Meiner, Leipzig, in 1910, his copy of which is now part of the Einstein estate at the Hebrew University in Jerusalem.

## CHAPTER 1

that “neither intellect nor will appertain to God’s nature.” He therefore denied the Judeo-Christian conception of a personal God. What the Bible refers to as divine activities are identified by Spinoza with the lawlike course of nature. God is the “infinite substance” having the attributes of extension and thought. God is devoid of ethical properties, for good and evil are only relative to human desires. What is commonly called “God’s will” is identical with the laws of nature. People do not act freely in the sense of having alternatives to their actions; their belief in freedom arises only from their ignorance of the causes of the desires that motivate their actions. The ultimate object of religious devotion can only be the perfect harmony of the universe, and human aspirations must accept the inexorable dictates of the deterministic laws that govern life.

Evidently, Einstein was enchanted by Spinoza’s *Ethics*, but he never considered himself an expert on Spinoza’s writings. In 1932, the tercentenary of Spinoza’s birth, Einstein was asked by several people to write about Spinoza but refused. For example, Siegfried Hessing, a publicist from Czernowits, Rumania, invited him to join Henri Bergson, Sigmund Freud, Stefan Zweig, Romain Rolland, and others in writing a series of essays in honor of Spinoza. Einstein replied, “Unfortunately, to love Spinoza does not suffice to be allowed to write about him; this one must leave to those who have gone further into the historical background.”<sup>56</sup> When asked by Dr. Dagobert Runes, a New York book publisher, to write a short essay on “the ethical significance of Spinoza’s philosophy,” he declined the invi-

<sup>56</sup> Einstein to S. Hessing, 8 September 1932. Einstein Archive, reel 33-288.

#### RELIGION IN PRIVATE LIFE

tation on the following grounds, "I do not have the professional knowledge to write a scholarly article about Spinoza. But what I think about this man I can express in a few words. Spinoza was the first to apply with strict consistency the idea of an all-pervasive determinism to human thought, feeling, and action. In my opinion, his point of view has not gained general acceptance by all those striving for clarity and logical rigor only because it requires not only consistency of thought but also unusual integrity, magnanimity and—modesty."<sup>57</sup>

Obviously, it was not so much Einstein the physicist as Einstein the philosopher who admired Spinoza. Any attempt to explain his veneration of Spinoza by claiming that the *Ethics* somehow anticipated Einstein's scientific thought, that Spinoza's notion of "substance" ("substantia") or its attribute "extension" ("extension" as used, e.g., in proposition 2 of part 2 of the *Ethics*) anticipated the concept of space-time as used in the special or general theory of relativity, is artificial and unwarranted for it ignores the historical context of these notions.<sup>58</sup> The only connecting link between Spinoza's philosophy and Einstein's physics and philosophy is the idea of an unexceptionable determinism, which, as seen below,

<sup>57</sup> "Spinoza ist der Erste gewesen, der den Gedanken der deterministischen Gebundenheit alles Geschehens wirklich konsequent auf das menschliche Denken, Fühlen und Handeln angewendet hat. Nach meiner Ansicht hat sich sein Standpunkt unter den um Klarheit und Folgerichtigkeit kämpfenden nur darum nicht allgemein durchsetzen können, weil hierzu nicht nur Konsequenz des Denkens, sondern auch eine ungewöhnliche Lauterkeit, Seelengrösse und—Bescheidenheit gehört." Einstein to D. Runes, 8 September 1932. Einstein Archive, reel 33-286.

<sup>58</sup> For a thorough critique of such misinterpretations, see M. Paty, "Einstein and Spinoza," in M. Grene and D. Nails, eds., *Spinoza and the Sciences* (Reidel, Dordrecht, 1986), pp. 267–302.

## CHAPTER 1

decisively influenced Einstein's religious credo. Einstein also greatly admired Spinoza's lack of ego, his flight from the "merely personal" throughout his writings. The separation of the excommunicated Jew from his family and home also contributed to Einstein's sympathy for Spinoza. In spite of his unprecedented fame and international adulation, Einstein ultimately remained, as he called himself, a "lone traveler: I have never belonged to my country, my home, my friends, or even my immediate family, with my whole heart. . . . I have never lost a sense of distance and a need for solitude," he confessed in 1930.<sup>59</sup>

Einstein felt akin to Spinoza because he realized that they shared a need for solitude as well as the fate of having been reared within the Jewish heritage but having become subsequently alienated from its religious tradition. Einstein's opinion about the relation between Judaism and Spinozism can be gathered from his correspondence with Willy Aron, the author of a book on Spinoza. "Although I firmly believe," wrote Einstein, "that the chasm between Jewish theology and Spinozism can never be bridged, I am not less convinced that Spinoza's contemplation of the world ("Weltanschauung") was thoroughly imbued with the principles and sentiments that characterize so many Jewish intellectuals. I feel I would never have come so near to Spinoza had I not myself been of Jewish extraction and grown up in a Jewish milieu."<sup>60</sup> In a similar vein, the late Harry Austryn Wolfson, professor of Jewish philosophy at Harvard University wrote in his important treatise on

<sup>59</sup> A. Einstein, "What I Believe," *Forum and Century* 84, 193-194 (1930); reprinted in *Ideas and Opinions*, pp. 8-11.

<sup>60</sup> Einstein to W. Aron, 14 January 1943. Einstein Archive, reel 33-296.

#### RELIGION IN PRIVATE LIFE

Spinoza's philosophy, "We cannot get the full meaning of what Benedictus says unless we know what has passed through the mind of Baruch."<sup>61</sup>

Einstein was most influenced by Spinoza's thesis of an unrestricted determinism and the belief in the existence of a superior intelligence that reveals itself in the harmony and beauty of nature. In any case, these were the interpretations that Einstein gave to Proposition 29 in the first part of Spinoza's *Ethics*: "In rerum natura nullum datur contingens, sed omnia ex necessitate divinae naturae determinata sunt ad certo modo existendum, et corporandum" [In the nature of things nothing is contingent but all things are determined by the necessity of divine nature existing and operating in a certain mode], and to the expression "divina natura" or "deus sive natura," respectively. Unrestricted determinism, Einstein argued, does not admit a "God who rewards and punishes the objects of his creation and whose purposes are modeled after our own."

Like Spinoza, Einstein denied the existence of a personal God, modeled after the ideal of a superman as we would say today. In accordance with Jewish thought, both Einstein and Spinoza conceived of God as an abstract entity in accordance with the biblical "Thou shalt not make unto thee a graven image, or any likeness of any thing" (Exodus 20:4) and in accordance with Maimonides' *Third Principle of Faith*, "I firmly believe that . . . no bodily accidents apply to Him, and that there exists nothing whatever [that] resembles Him."<sup>62</sup>

<sup>61</sup> H. A. Wolfson, *The Philosophy of Spinoza* (Harvard University Press, Cambridge, Mass., 1934), vol. 1, p. vii.

<sup>62</sup> See, e.g., P. Birnbaum, ed., *Daily Prayer Book* (Hebrew Publishing, New York, 1949), p. 154.

## CHAPTER 1

When Einstein was once asked to define God, he gave the following allegorical answer,

I'm not an atheist, and I don't think I can call myself a pantheist. We are in the position of a little child entering a huge library filled with books in many languages. The child knows someone must have written those books. It does not know how. It does not understand the languages in which they are written. The child dimly suspects a mysterious order in the arrangement of the books but doesn't know what it is. That, it seems to me, is the attitude of even the most intelligent human being toward God. We see the universe marvelously arranged and obeying certain laws but only dimly understand these laws. Our limited minds grasp the mysterious force that moves the constellations. I am fascinated by Spinoza's pantheism, but admire even more his contribution to modern thought because he is the first philosopher to deal with the soul and body as one, and not two separate things.<sup>63</sup>

At about the same time, in April 1929, Cardinal O'Connell, Archbishop of Boston, admonished the members of the New England Catholic Club of America not to read anything about the theory of relativity, because it is a "befogged speculation producing universal doubt about God and his Creation . . . cloaking the ghastly apparition of atheism."<sup>64</sup>

Worried by the Archbishop's exprobration, Rabbi Herbert

<sup>63</sup> G. S. Viereck, *Glimpses of the Great* (Macauley, New York, 1930), quoted by D. Brian, *Einstein—A Life*, p. 186.

<sup>64</sup> *New York Times*, 25 April 1929, p. 60.

#### RELIGION IN PRIVATE LIFE

S. Goldstein of the Institutional Synagogue in New York cabled Einstein, "Do you believe in God? Stop. Prepaid reply fifty words." Einstein replied, "I believe in Spinoza's God who reveals himself in the orderly harmony of what exists, not in a God who concerns himself with fates and actions of human beings." Rabbi Goldstein commented that this reply

very clearly disproves . . . the charge of atheism made against Einstein. In fact, quite the reverse is true. Spinoza, who is called "the God-intoxicated man" and who saw God manifest in all of nature, certainly could not be called an atheist. . . . Einstein's theory, if carried out to its logical conclusions would bring mankind a scientific formula for monotheism. He does away with all thought of dualism or pluralism. There can be no room for any aspect of polytheism.<sup>65</sup>

Chapman Cohen, president of the National Secular Society in England, an association mostly of freethinkers, devoted a whole chapter of his book, *God and the Universe*, to his claim that this communication between Goldstein and Einstein actually led to an affirmation of atheistic ideology. "The portraits we have seen of Einstein," Cohen wrote, "show him to be not destitute of humour, and we fancy he must have felt he was doing a little 'leg-pulling' when he gave his answer to Rabbi Goldstein."

Einstein's declaration that he believes in the God of Spinoza can be of no use to anybody who is religious. If God, according to Einstein, is not concerned with the actions and prayers of man, Cohen continued, it is obviously of no use to pray to him. "One might as well pray to the Albert Memo-

<sup>65</sup> Ibid.

## CHAPTER 1

rial. . . . What significance have all the churches, synagogues, mosques, and other gathering places of the religiously afflicted if they are worshipping a God who takes no interest in their fates or their actions." Einstein's confession is but a confession of "practical atheism," because there is no difference between there being no God to bother about man, and there being a God who does not concern himself with the fates and actions of human beings.

Spinoza's God is thoroughly deterministic, and, "if one translates his ideas into modern terms, completely atheistic." Goldstein's praise of Einstein's reply as "a scientific formula for monotheism" only shows that "we have reached the stage where genuine religion finds it increasingly hard to live honestly, and altogether lacks the courage to die with courage and dignity. Anything will do, so long as it is given the name of God. It is still a term which exerts a hypnotic power over the unthinking, and it is by the support of the unthinking that established religion today hopes to carry on." Cohen concluded this chapter with the remark that "one can imagine the twinkle in the eyes of Albert Einstein when he replied to the Rabbi's inquiry, 'I believe in Spinoza's God.' Perhaps he whispered to himself, 'And that is no god at all.'"<sup>66</sup>

But Einstein always made a sharp distinction between his disbelief in a personal God and atheism. Not long after he had cabled his answer to Rabbi Goldstein, he received from Eduard BÜsching of Stuttgart a copy of BÜsching's book, entitled *Es gibt keinen Gott* [*There Is no God*], published under the pseudonym Karl Eddi.<sup>67</sup> This book defines

<sup>66</sup> C. Cohen, *God and the Universe*, 3d ed. (Pioneer Press, London), pp. 126–132.

<sup>67</sup> K. Eddi, *Es gibt keinen Gott—Bekenntnisse eines Unbekannten* (Koch, Neff & Oetinger, Stuttgart, 1929).

#### RELIGION IN PRIVATE LIFE

religion as “the abortive attempt, roused by deference and fear of the unknown, to establish a direct and personal relation to an imaginary superior being God or Gods, resembling mankind and ruling it, but not existing in reality.” It concludes with the statement, “Where science grows, religion wanes; where religion thrives, science withers,”<sup>68</sup> the exact antithesis of Einstein’s statement “Science without religion is lame, religion without science is blind.”<sup>69</sup>

Einstein courteously responded that the book did not deal with the notion of God but only with that of a personal God and therefore should be called *Es gibt keinen persönlichen Gott*. He continued,

We followers of Spinoza see our God in the wonderful order and lawfulness of all that exists and in its soul (“Beseeltheit”) as it reveals itself in man and animal. It is a different question whether belief in a personal God should be contested. Freud endorsed this view in his latest publication. I myself would never engage in such a task. For such a belief seems to me preferable to the lack of any transcendental outlook of life, and I wonder whether one can ever successfully render to the majority of mankind a more sublime means in order to satisfy its metaphysical needs.<sup>70</sup>

Einstein, as we see, was far from disputing the usefulness of religious education; he objected to it, as he had for his children, only when he suspected that the major objec-

<sup>68</sup> “Wo Wissen Macht, da stirbt der Glaube, wo der Glaube herrscht, verweht der Geist.” Ibid., p. 73.

<sup>69</sup> A. Einstein, “Science and Religion.”

<sup>70</sup> Einstein to E. Büsching, 25 October 1929. Einstein Archive, reel 33-275.

## CHAPTER 1

tive was to teach religious ceremonies or formal rituals instead of the development of ethical values. Einstein's conception of the relation between religion and ethics is closely analyzed in chapter 2. According to Einstein, even science at an advanced stage, cannot define, let alone commend, ethical values. For science is confined to what *is* and ethics to what *should be*, and no path leads from the knowledge of what is to the knowledge of what should be.

In 1930, Einstein was invited by the *New York Times* to contribute an essay on his conception of the relation between science and religion. In this article, entitled "Religion and Science,"<sup>71</sup> Einstein used, apparently for the first time, the term "cosmic religious feeling" to describe the emotional state that one experiences when one recognizes the "futility of human desires and the sublimity and marvelous order which reveals itself both in nature and in the world of thought." In assuming *one* order in nature and in thought, Einstein followed, consciously or not, Spinoza's doctrine: "Ordo et connexio idearum idem est, ac ordo et connexio rerum."<sup>72</sup> This Spinozistic tenet underlies Einstein's epistemological realism, his belief that a rational explanation of the universe is possible, his belief in the "mysterious comprehensibility of the world." It explains, for example, Einstein's reaction to Eddington's cable containing the re-

<sup>71</sup> A. Einstein, "Religion and Science," *New York Times Magazine*, 9 November 1930, section 5, pp. 1-4; German translation in *Berliner Tagblatt*, 11 November 1930, pp. 1-3; reprinted as the title essay in *Cosmic Religion with Other Opinions and Aphorisms* (Covici-Friede, New York, 1931), pp. 43-54; also in *The World as I See It* (Philosophical Library, New York, 1949), pp. 24-28; and in *Ideas and Opinions* (Crown, New York, 1954, 1982), pp. 36-40.

<sup>72</sup> "Order and connection of ideas is the same as order and connection of things." B. Spinoza, *Ethica*, Proposition 7, part 2.

## RELIGION IN PRIVATE LIFE

sults of the 1919 expedition to measure the deflection of light in a gravitational field. On receiving the cable, Einstein's assistant Ilse Rosenthal-Schneider expressed her joy that these astronomical observations confirm the general theory of relativity, and Einstein reportedly said, "But I knew that the theory was correct." When she asked him, "What if there had been no confirmation of the predictions?" he countered, "Then I would have been sorry for the dear Lord—the theory is correct."<sup>73</sup>

However, when Einstein later applied this parallelism between "ordo idearum" and "ordo rerum" in his study of quantum mechanics, his insistence on the *primacy* of an unrestricted determinism somewhat abated. In fact, as Wolfgang Pauli wrote in 1954 to Max Born, "Einstein does not consider the concept of 'determinism' to be as fundamental as it is frequently held to be (as he told me emphatically many times). . . . [H]e disputes that he uses as a criterion for the admissibility of a theory the question: 'Is it rigorously deterministic?'"<sup>74</sup>

This shift in Einstein's position was, partially at least, the result of his failure to disprove the Heisenberg indeterminacy relations, which form an integral part of the stan-

<sup>73</sup> I. Rosenthal-Schneider, "Reminiscences of Conversation with Einstein," 23 July 1957; "Reminiscences of Einstein," in H. Woolf, ed., *Some Strangeness in the Proportion* (Addison-Wesley, Reading, Mass., 1980), p. 523.

<sup>74</sup> "Insbesondere hält Einstein (wie er mir ausdrücklich wiederholte) den Begriff 'Determinismus' nicht für so fundamental wie es oft geschieht und leugnete energisch . . . das er 'als Kriterium für eine zulässige Theorie' die Frage benutzt: 'ist sie streng deterministisch?'" Letter from W. Pauli to M. Born, dated 31 March 1954. *Albert Einstein—Hedwig und Max Born, Briefwechsel* (Nymphenburger Verlags-handlung, München, 1969), p. 293; *Born-Einstein Letters*, p. 221.

## CHAPTER 1

standard version of quantum mechanics. These relations deny the ascertainability of measuring the exact initial values of canonically conjugate observables, such as the position and the momentum of a particle, which are necessary for the prediction of the future state of the system and thus deprive the notion of determinism of any physical meaning. Even if they do not imply the possibility of proving the nonexistence of determinism, they imply at least the impossibility of proving the existence of determinism.

The principle that Einstein, as a consequence of his critique of quantum mechanics, considered even more fundamental than the requirement of determinism, was called by him the "Trennungsprinzip" (principle of separation).<sup>75</sup> It demands that the outcome of a measurement performed on a physical system cannot depend on the outcome of a measurement performed simultaneously on another system that is spatially separated from the first one; or, briefly expressed, it denies the possibility of an immediate interaction between spatially separated systems. How Einstein arrived, via the famous 1935 "Einstein-Podolsky-Rosen incompleteness argument," at this principle and why he attached such importance to it is explained in chapter 3 in the context of certain claims for a theological significance of this principle.

Compared with Einstein's rejection of his earlier endorsement of Mach's positivism in favor of a rational realism as a result of his work on general relativity, the present partial demotion of determinism in favor of the principle of separation was, of course, only a minor change in his philosophy of science.<sup>76</sup> Moreover, because this shift did

<sup>75</sup> The term "Trennungsprinzip" was used in Einstein to E. Schrödinger, 9 June 1935. Einstein Archive, reel 22-047.

<sup>76</sup> For Einstein's gradual disengagement from Mach's positivism,

#### RELIGION IN PRIVATE LIFE

not imply a denial of determinism, its effect on Einstein's conception of religion cannot be expected to have been very serious. Indeed, in 1935 and thereafter, Einstein did not revise his former religious conviction. It may be significant, however, that, although most of his writings about religion and its relation to science date to the period from 1930 to 1935, his interest in this subject after that period—that is, after the publication of the Einstein-Podolsky-Rosen paper—seems to have waned; only occasionally was it rekindled by epistolatory inquiries.

DID EINSTEIN'S conception of religion or his religious sentiments affect his scientific work? Two questions are involved. First, was his religiosity a psychological or spiritual driving force that stimulated him to endure the hardships of concentrated work, sometimes under quite difficult physical conditions? Second, did his religious conceptions affect the very substance of his work; in other words, was the content of his physical theories influenced by what he called his cosmic religion?

Einstein himself answered the first question—though not with respect to himself but with respect to other great physicists—when he declared, "What a deep conviction of the rationality of the universe [the Spinozistic-Einsteinian expression for religiosity] . . . Kepler and Newton must have had to enable them to spend years of solitary labor in disentangling the principles of celestial mechanics!"<sup>77</sup>

Einstein never said that his religious feelings strengthened his capability to work, unless we interpret his dictum

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see G. Holton, "Mach, Einstein, and the search for reality," *Daedalus* 97 (1968): 636–673, reprinted in Holton, *Thematic Origins of Scientific Thought*, pp. 219–259.

<sup>77</sup> A. Einstein, *Ideas and Opinions*, p. 39.

## CHAPTER 1

"Science without religion is lame" in that way.<sup>78</sup> If we recall that, for him, music was an expression of religious feeling and that often, while playing music, he "suddenly" found the solution to a scientific problem that had intrigued him for some time, then a positive answer to the first question cannot be totally discarded. As far as we know, the last few days before completing the general theory of relativity probably encompassed the most concentrated work of his life. A vivid description of those days, reported by his wife Elsa, can be found in Charles Chaplin's autobiography:

The Doctor came down in his dressing gown as usual for breakfast but he hardly touched a thing. I thought something was wrong, so I asked what was troubling him. "Darling," he said, "I have a wonderful idea." And after drinking his coffee, he went to the piano and started playing. Now and again he would stop, making a few notes then repeat: "I've got a wonderful idea, a marvelous idea!" I said: "Then for goodness' sake tell me what it is, don't keep me in suspense." He said: "It's difficult, I still have to work it out."

She told me he continued playing the piano and making notes for about half an hour, then went upstairs to his study, telling her that he did not wish to be disturbed, and remained there for two weeks. "Each day I sent him up his meals," she said, "and in the evening he would walk a little for exercise, then return to his work again. Eventually," she said, "he came down from his study looking very pale. 'That's it,' he told me, wearily putting two sheets of paper on the table. And that was his theory of relativity."<sup>79</sup>

<sup>78</sup> A. Einstein, "Science and Religion."

<sup>79</sup> C. Chaplin, *My Autobiography* (Bodley Head, London, 1964), pp.

## RELIGION IN PRIVATE LIFE

If his religious sentiments, either directly or through their expression by music, gave him the strength and enthusiasm to work so strenuously in developing his general theory of relativity, then these feelings certainly also motivated his indefatigable tenacity in searching for a unified field theory, a task on which he embarked soon after the completion of his general theory. His aim, as he described it once to his former student Fritz Zwicky, was "to obtain a formula that will account in one breath for Newton's falling apple, the transmission of light and radio waves, the stars, and the composition of matter." As is well known, he did not succeed, but in spite of innumerable disappointments, he never ceased to believe that there *ought* to exist such a theory. This belief may well have been rooted in his Spinozistic conviction in the unity of nature: "Deum unicum, hoc est in rerum natura non nisi unam substantiam dari." [God is One, hence in the nature of things only one substance is given; *Ethics*, corollary 1 to proposition 14, part 1]. Spinoza taught that nature is divine and God is One, and the most fundamental maxim of Judaism, the "Shma' Israel" ("Hear, O Israel, the Lord is our God, the Lord is One"; Deuteronomy 6:4) was well known to Einstein from his early religious instruction.<sup>80</sup> Clearly Einstein's indomitable striving throughout his later lifetime for "oneness" in physics provides a positive answer to both questions

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346–347. Elsa gave this report early in 1931 at Chaplin's Beverly Hills home during a dinner party to which she and Albert had been invited by Chaplin after a sightseeing tour of Los Angeles. It was Einstein's second visit to America, spent mainly at the California Institute of Technology in Pasadena.

<sup>80</sup> The oneness of God is also declared in the New Testament, I *Corinthians* 1:8: "There is no God but one," and in the Koran, *Sura* 112: "There is God, the One and Only."

## CHAPTER 1

posed above; it accounts for his self-devotion to his work as well as for the substance of his work.

We can see that the answer to the second question is positive in other respects, apart from Einstein's search for a unified field theory. For Einstein's religious conviction, following Spinoza, was based on the assumption of an unrestricted determinism, according to which, not only the motions of massive gravitating bodies, such as the stars, but also atomic processes are ruled by strict deterministic laws. Hence, Einstein's persistent objection to the new quantum mechanics, on the grounds that "God does not play at dice," was, at least to some extent, religiously motivated. Others, for example, Cornelius Lanczos, who had been working with Einstein for some time in Berlin, and Georg Herz Shikmoni, the chairman of the Spinozaeum in Haifa, claimed that certain specific physical ideas in the theory of relativity were influenced by religious considerations.<sup>81</sup> Shikmoni even declared that Einstein's famous mass-energy relation, usually expressed by the formula  $E = mc^2$ , corresponds to a proposition in the *Ethics*.<sup>82</sup>

All those mentioned who believed that Einstein's theory of relativity was to some extent religiously influenced or motivated were convinced that such motives did not impair but rather enhanced the development of the theory without damaging its scientific importance. The opposite

<sup>81</sup> C. Lanczos, *Judaism and Science* (Leeds University Press, Leeds, 1970).

<sup>82</sup> "Ich möchte in diesem Zusammenhang auf die Verwandtschaft der Einsteinformel  $E = m c^2$  mit Spinozas Lehre hinweisen: "Die Körper sind mit Bezug auf Bewegung und Ruhe, Schnelligkeit und Langsamkeit, nicht aber in Bezug auf die Substanz, von einander unterschieden." (*Ethics* II, proposition 13, corollary 1). G. H. Shikmoni to O. Nathan, 14 January 1957. Einstein Archive, reel 33-311.

#### RELIGION IN PRIVATE LIFE

claim, that religious motivation corrupted the theory, was also made, though in a totally different context and for totally different intents. When, with the rise of Hitlerism in Germany, Einstein, the humanitarian, Jew, and pacifist, became the target of political and ideological attacks, his theory of relativity was proclaimed a typical product of "Jewish Physics," which tries to deprive true physics or "Aryan Physics" of its foundations. To substantiate this claim, Nazi ideologists tried to show that the development of the theory of relativity had been strongly influenced by the Talmud, that ancient body of religious and civil laws consisting of the Mishnah and Gemara, both commentaries on the Bible. The following excerpt from the *Zeitschrift für die gesamte Naturwissenschaft*, a periodical purposely founded for propaganda, is a typical example of such a Nazi polemic.

The mode of thought that finds its expression in Einstein's theory is known, when applied to other ordinary things, as "Talmudic thinking." The task of the Talmud is to fulfill the precepts of the Torah, the Biblical law, by circumventing them. This is accomplished by means of suitable definitions of the concepts occurring in the law and by a purely formalistic mode of interpreting and applying them. Think about the Talmud Jew who places a food basket under his seat in a railway car, thus turning it formally into his residence and obeying thereby formally the law that on the Sabbath one should not travel more than a mile from his residence. It is this formal fulfillment that is important for the Jew. . . . This formalistic Talmudic thinking also manifests itself in Jewish physics. Within the theory of relativity, the principle of the constancy of the velocity

## CHAPTER 1

of light and the principle of the general relativity of the phenomena in nature represent the “Torah,” which under all circumstances must be fulfilled. For this fulfillment, an elaborate mathematical apparatus is necessary; and just as previously the concept of “residence” . . . was rendered lifeless and given a more expedient (zweckentsprechende) definition, so in the Jewish relativity theory, the notions of space and time are deprived of all spirit and defined in an expedient, purely intellectual way. This analogy is not accidental or artificial, it is deeply rooted in the very essence of Judaism. It exposes itself, for example, when Einstein declares in his “The Foundations of the General Theory of Relativity”: “It will be seen from these reflections that in pursuing the general theory of relativity we shall be led to a theory of gravitation, since we are able to ‘produce’ a gravitational field merely by changing the system of coordinates.”<sup>83</sup>

If we consider this statement from a purely factual point of view, that is, if we ignore its obviously anti-Semitic tone, it still remains a flagrant falsification for several reasons. First, there is no law, biblical or rabbinical, that allows traveling on Shabbat “in a railway car” or any other vehicle, except if it is a matter of preserving life, for the Shabbat was made for man and not man for Shabbat (Talmud, Yoma, 85 b). The Shabbat was ordained as a day of rest

<sup>83</sup> B. Thüring, “Physik und Astronomie in jüdischen Händen,” *Zeitschrift für die gesamte Naturwissenschaft* 3, pp. 55–70 (May–June 1937); Bruno Thüring iterates here almost verbatim statements made by Hans Alfred Grunsky in his pamphlet *Der Einbruch des Judentums in die Philosophie* (Schriften der Deutschen Hochschule für Politik, Heft 14), (Junker & Dünnhaupt, Berlin, 1937), pp. 17–18.

#### RELIGION IN PRIVATE LIFE

even for slaves and animals to commemorate “creation and the redemption from Egypt” (Exodus 20:8; Deuteronomy 5:15).<sup>84</sup>

Second, it is absurd to claim that Einstein was influenced by the Talmud. Although he once declared “that as a child he received instruction in the Bible and in the Talmud,” there can be no doubt that he never really studied the Talmud;<sup>85</sup> for German Jews, unlike the Jews of Eastern Europe, rarely read the Talmud. It might perhaps be objected that Einstein had been indirectly influenced by the Talmud through Spinoza, because the young Spinoza had studied the Talmud in Amsterdam when he was a disciple of Rabbi Manasse BenIsrael whose portrait has been immortalized by Rembrandt. It was not the Talmudist from Amsterdam, but the philosopher of Voorburg, the author of the *Ethics* whom Einstein admired and with whom he felt a kinship.

It is, of course, true that the Talmud, representing different rabbinical interpretations of biblical laws, has a distinct style of its own, not very dissimilar to that of the scholastic theological writings. Its often extremely meticulous distinctions were not intended, as Thüring and Grunsky assert, to make it possible to deceive oneself or somebody else, but merely to clarify unresolved obscurities. Finally, if it were true that the study of the Talmud, often regarded as promoting critical thinking, had really inspired the creation of the theory of relativity, which has rightly been called “one

<sup>84</sup> For details of the rabbinical interpretation of Exodus 16:29 (“Let no man go out of his place on the seventh day”), see *The Mishnah* (Shabbat Eruvin, chap. 3-5, Seder Moad), e.g., in the English translation (P. Kehati, ed., Elineri Library, Jerusalem, 1990), pp. 33–87.

<sup>85</sup> He made this declaration in his interview with Viereck (Viereck, *Glimpses of the Great*, and D. Brian, *Einstein—A Life*, p. 186).

## CHAPTER 1

of the great triumphs of human thought,"<sup>86</sup> then modern science would be deeply indebted to the Talmud.

Not only Einstein's greatest success, his general theory, but also what he once called, as reported by George Gamow, "the biggest blunder of my life" has been claimed to have been religiously motivated.<sup>87</sup> To understand this claim, we must recall that soon after having obtained the field equations of general relativity, Einstein applied them to the universe as a whole. His paper "Kosmologische Betrachtungen zur allgemeinen Relativitätstheorie," published in 1917, initiated the modern study of relativistic cosmology and raised thereby the status of cosmology, which theretofore had been a jumble of speculations, to that of a respectable scientific discipline.<sup>88</sup>

Einstein thought that his first cosmological solution of the field equations was a failure and rejected it because it yielded a nonstatic (expanding) universe. He thus missed the chance of announcing the expansion of the universe as perhaps the most important prediction of his general theory. That the universe is, in fact, steadily expanding was revealed only in the late 1920s by Edwin Powell Hubble's observations at the Mount Wilson Observatory. In 1917, Einstein modified the field equations by introducing—

<sup>86</sup> Address of the President, Sir J. J. Thomson, at the Anniversary Meeting, *Proceedings of the Royal Society, London*, A96 (1919): 311–322, quotation on p. 317.

<sup>87</sup> G. Gamow, *My Worldline* (Viking Press, New York, 1970), p. 44.

<sup>88</sup> A. Einstein, "Kosmologische Betrachtungen zur allgemeinen Relativitätstheorie," *Sitzungsberichte der Preussischen Akademie der Wissenschaften 1917*, part 1, pp. 142–152; "Cosmological Considerations on the General Theory of Relativity," *The Collected Papers of Albert Einstein*, vol. 6 (Princeton University Press, Princeton, N.J., 1996), pp. 543–551.

#### RELIGION IN PRIVATE LIFE

without violating their covariance—an additional term, the so-called “cosmological constant  $\lambda$ ,” in order to obtain a static unchanging universe. It was this introduction of  $\lambda$  that Einstein called his “biggest blunder.” It has been suggested that Einstein committed this “blunder” because he was influenced by Spinoza who, in his *Ethics* declared, “God is immutable or [which is the same thing] all his attributes are immutable,” and “an extended thing [like space] (and a thinking thing) are God’s attributes.”<sup>89</sup> In accordance with Spinoza, Einstein interpreted the term “endure” in the verse “the Heavens endure from everlasting to everlasting” in the sense of an immutable existence.

<sup>89</sup> “Deum, sive omnia Dei attributa esse immutabilia,” *Ethics*, col. 2 to proposition 20, p. 1; “rem extensam (et rem cogitantem) Dei attributa esse,” *ibid.*, col. 2 to proposition 14.