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Science and the Liberal Arts in Education

By FRANCIS NEILSON

I

IT IS MANY a long day since what is now called religious "superstition" has had the slightest influence upon the routine of daily existence. Church-goers seemingly find no difficulty in separating their Sabbatical observances from the practical affairs of their business lives. Millions in the countries of western civilization try, more or less, to practice the tenets of their various faiths, without much fear of the civil penalties that would fall upon them if they should be caught transgressing the financial and commercial statutes of the State. In the social realm, crime has increased so rapidly in all branches of offenses that the statistics of government investigators prove that Egon Friedell was not wrong when he said "the nineteenth century is the inhuman century *par excellence*."¹ And now that the return to barbarism is undoubtedly a world tendency, we cannot be in the least surprised to learn from the head of the Federal Bureau of Investigation:

Last year a major crime occurred every twenty-three seconds. More persons were murdered within the United States than there were casualties at Tarawa. A robbery occurred every twelve minutes, a burglary every two minutes, a larceny every thirty-nine seconds and an automobile was stolen every three minutes. Remember that 13 per cent of all murderers arrested were under 21 years of age, as were 39 per cent of all robbers, 55 per cent of all burglars, 37 per cent of all thieves, 32 per cent of all rapists, 30 per cent of all arsonists and 65 per cent of all car thieves. . . .²

It cannot be denied that this condition of affairs has arisen within the period when the modern notion of education has been accepted and while the "progressives" have been at work in the schools making vain attempts to teach boys and girls how to make a living. It may be merely a peculiar coincidence that, since Greek and Latin were considered impediments to a technical education, we have indulged in wars that would make a pagan blush. Yet, from the day when devotion to the "scientific method" was introduced into the classrooms of colleges, an educated person has been looked upon as a curiosity and is still regarded as a high-brow.

¹ "A Cultural History of the Modern Age" (3 vols.), trans. by Charles Francis Atkinson, New York, Alfred A. Knopf, 1931.

² Speech of J. Edgar Hoover before the National Congress of the Daughters of the American Revolution, New York City, April 17, 1944.

My purpose in introducing this subject is rather a selfish one. I am looking for information, because my position is not one of intellectual security. I wish to be informed by those who support the "scientific method" in education about what is to become of an educated man in a world of technical specialists. From time to time I meet, in a social way, the products of the new system and, as one of them admitted some time ago, they are mighty dull companions. For example, the global war has exposed their lack of knowledge about geography. The references that appear now and then to places in Europe which are being stormed by shot and shell make them conscious that they have neglected ordinary courses in history that boys of sixteen had to take when I went to school. How many of our technologists know the story of Aachen and what Charles the Great meant to European civilization? When the fight was in progress at Monte Cassino, I was frequently asked questions by my friends about the history of the monastery, and all were very much surprised to learn that it was one of the great foundation schools of European education.³

However, it is unnecessary to drive this point further, for the men themselves admit they are short on nearly all subjects except the one in which they specialize. Perhaps this does not matter, for all these people seem to be making a living and, when they have leisure, take a keen interest in various field sports and devote long hours at night to bridge. What more can a hard-working technician require in the way of recreation? Yet, it is incumbent upon the "progressives" to tell old-fashioned persons like myself by what right they claim that the new methods in education are superior to those upon which European civilization at its best put the hallmark of perfection.

II

TO GO NO FARTHER BACK than Plato, must all the philosophers and scientists of the classical and Christian culture of Europe be ruled out of court because it is alleged that they were not concerned with the "scientific method," which has fared so badly since the practice of it was begun? When I read some of the criticism that is levelled against those who wish to restore what is called the liberal arts course in the colleges and universities, I am left with the haunting idea that the references of the critics to what they call medievalism are not based upon a knowledge that entitles them to make a judgment. From their volumes (and let me say here that I strive to follow them almost as quickly as they appear in print) I gather that the "scientific method" does not help them to understand the character and attainment of the men of the long ago they are so ready to criticize.

³ Francis Neilson, "The Roots of the Tree of Learning," *AM. JOUR. ECON. SOCIO.*, Vol. 2, No. 3 (April, 1943), pp. 305-23.

For example, a well-known physiologist was amazed to learn that three companions in the thirteenth century were friars and that they were mathematicians and physicists. When I told him that Roger Bacon, Robert Grosseteste, and Edmund Rich foreshadowed some of the greatest discoveries of later generations, he—a scientist—admitted his ignorance. And yet there seems to be no reason why a man who has perfected himself in one branch of learning, or specialized in a particular science, should be unaware of these important facts, because there is a voluminous literature on these subjects, which is accessible to any inquiring mind. Spengler himself (to mention only one in recent years) has given us in "The Decline of the West"⁴ an all-too-brief notion of the scientific attainments of the men of the Middle Ages—from St. Augustine, one of the first evolutionists, down to Nicholas of Cusa:

. . . Nicolaus Cusanus, Cardinal and Bishop of Brixen (1401–1464), brought into mathematics the "infinitesimal" principle, that *contrapuntal method* of number which he reached by deduction from the idea of God as Infinite Being. It was from Nicholas of Cusa that Leibniz received the decisive impulse that led him to work out his differential calculus; and thus was forged the weapon with which dynamic, Baroque, Newtonian, physics definitely overcame the static idea characteristic of the Southern physics that reaches a hand to Archimedes and is still effective even in Galileo.⁵

Nearly a hundred years before Nicholas of Cusa, another Nicolas—Oresme—Bishop of Lisieux (1323–1382), was the first western scientist, according to Spengler, to use "co-ordinates so to say elastically and, more important still, to employ fractional powers—both of which presuppose a number-feeling, obscure it may be but quite unmistakable, which is completely non-Classical and *also* non-Arabic."⁶

Charles Atkinson, the translator of "The Decline of the West," tells us in a footnote that "Oresme was, equally, prelate, church reformer, scholar, scientist and economist—the very type of the philosopher-leader."

Now to show the curious paradox that is reached in the meeting of extremes—the Classical and the western schools. Spengler says:

. . . In the whole panorama of history, innumerable and intense as historical relations are, we find no two things so fundamentally alien to one another as these. And it is because extremes meet—because it may be there is some deep common origin behind their divergence—that we find in the Western Faustian soul this yearning effort towards the Apollinian ideal,

⁴ Trans. by Charles Francis Atkinson (2 vols.), New York, Alfred A. Knopf, 1926.

⁵ *Ibid.*, Vol. I, p. 236.

⁶ *Ibid.*, p. 73.

the only alien ideal which we have loved and, for its power of intensely living in the pure sensuous present, have envied.⁷

III

PERHAPS THERE MAY BE a "progressive" who will explain to me why the "superstitious" notions of the Catholic faith did not deter its members who devoted long years to experimental research on the frontiers of science. There seems to be an extraordinary hitch somewhere that precludes the possibility of appreciating how the first scientific ladders were raised by the Church, and how they enabled the men of our day to climb to higher plains of knowledge.

It seems to me that the term "superstition," as it was used by the agnostics of the eighteenth century, has been misapplied by our sponsors of the "scientific method," with the result that it has engendered a prejudice. And it may be pointed out that the religious field is only one in which "superstition" is cultivated. The political field is so full of superstition, as all history shows, that it has become a by-word. It is unnecessary to labor the point of the social superstitions that afflict people today. They are so manifold that only a dull-witted person can remain impervious to their most stupid contradictions.

But there has been no such "superstition" as that which has afflicted the modern educationist. Any man who thinks he can make a social being out of a strictly defined specialist is cultivating a superstition that beats anything ever indulged in in the religious realm. Of course, if a social being is one who can talk about the headlines in the newspapers, the score of the last baseball game, how often the opponents were set at bridge the night before, then of course there is nothing more to be said. Our world is so well off in such persons that serious conversation is now voted by nearly all people as an unmitigated bore.

Again I must plead for enlightenment on this charge of "superstition" as an oriental and medieval stumbling block being placed in the road of adherents of the "scientific method" by those who wish to restore the liberal arts to their proper place in institutions of learning. Will some authority on progressive education tell me why science advanced when men were so benighted as to worship God and so naïve as to study metaphysics and yield to contemplation? I do not press questions of belief and creed, for they concern the individual, nor do I ask for enlightenment on such matters as the practical value of metaphysics, its subdivision, ontology, or of behavioristic psychology. But I do wish to know why so many "pro-

⁷ *Ibid.*, p. 78.

gressives" find "superstition" a hindrance to scientific achievement. This is, indeed, an important and very perplexing question, and it should be made clear by our critics of the old system of education before we are all committed to one about which the sponsors seem to know little or nothing.

Will some "progressive" explain how three of many giants of science—Boyle, Faraday, and Maxwell—were able to accomplish their tasks while they held rigorously to their spiritual beliefs? They found no difficulty in worshipping God while they worked in their laboratories as scientists. Robert Boyle spent large sums in promoting the spread of Christianity, and he contributed to funds for translating the Bible into foreign languages. Michael Faraday was not handicapped as a scientist by his spiritual beliefs. Dr. Benice Jones tells us:

His standard of duty was supernatural. It was not founded upon any intuitive ideas of right and wrong, nor was it fashioned upon any outward experiences of time and place, but it was formed entirely on what he held to be the revelation of the will of God in the written word and throughout all his life his faith led him to act up to the very letter of it.⁸

Clerk Maxwell's name is to be found in nearly all works written by the physicists of our time. Dr. Tait says:

In private life Clerk Maxwell was one of the most lovable of men, a sincere and unostentatious Christian. Though perfectly free from any trace of envy or ill-will, he yet showed on fit occasion his contempt for that pseudo-science which seeks for the applause of the ignorant by professing to reduce the whole system of the universe to a fortuitous sequence of uncaused events.⁹

There are many men who were in the forefront of the scientists of the nineteenth century who might be quoted to show the progressives that there is no foundation whatever for their fear of the supernatural restricting the efforts of the scientist. One, whose name is forgotten although he was a great genius, is James Prescott Joule. From notes that were supposed to have been made for the draft of the address he was to deliver in 1873, as president of the British Association, I find the following remarkable passages:

After the knowledge of, and obedience to, the will of God, the next aim must be to know something of His attributes of wisdom, power and goodness as evidenced by His handiwork.

The study of nature and her laws [is] essentially a holy undertaking

⁸ Dr. Benice Jones (Secretary of the Royal Institution), "The Life and Letters of Faraday" (2 vols.), Longmans, 1870.

⁹ Dr. Peter Guthrie Tait's article on James Clerk Maxwell, in *The Encyclopaedia Britannica*, 13th ed., Vol. 17, p. 930.

[and] is of great importance and absolute necessity in the education of youth.¹⁰

Joule wrote that natural philosophy is second only to religion. Was it a misfortune that these scientists lived in the days when the liberal arts were deemed to be the essential bases of education?

Perhaps the difficulty that confronts the "progressive" lies here. The technicians and vocationalists in whom they are interested have nothing whatever to do with science proper. They are merely mechanics and, being so, their minds are directed to one feature of work, which is the highest test of their capacity. To inflict upon these people any "superstitious" ideas would be courting disaster, for only men possessed of a great desire for knowledge can study many questions and problems at the same time. Therefore, if we drop the word "science" altogether when we are referring to technicians and vocationalists, we might make a little progress. Let us just label them what they are—mechanics.

One of the great manufacturers of agricultural machinery has told me that, since he had to turn over 75 per cent of his plants for government orders, not less than 70 per cent of the extra labor required were men who had never used a drill; but, within two or three weeks, most of them were fitted for the jobs they had to undertake. This is one of the most illuminating things about technical and vocational training. The exigencies of finding labor to meet the enormous demands of the services has proved to manufacturers that it does not take long to teach a man how to put a nut upon a bolt.

IV

IN A RECENT NUMBER of *Fortune*,¹¹ Dr. John Dewey goes to some pains, in an article called "Challenge to Liberal Thought," to *restate the truth as he sees it*.¹² The first point that he makes is:

We are told that scientific subjects have been encroaching upon literary subjects, which alone are truly humanistic. We are told that zeal for the practical and utilitarian has resulted in displacement of a liberal education by one that is merely vocational, one that narrows the whole man down to that fraction of his being concerned with making a living. . . .¹³

Nowhere in the article does my learned colleague tell us who made the protest that "scientific subjects have been encroaching upon literary subjects." No one I know would make such an absurd statement. Science

¹⁰ H. Lowery, "The Joule Collection in the College of Technology, Manchester."

¹¹ August, 1944.

¹² Italics mine.

¹³ *Loc. cit.*, p. 155.

and the liberal arts (literary subjects) have been sister studies in the universities for at least a thousand years. Yet, Dr. Dewey admits:

In many details our criticisms of the present state of education do not differ widely from those of the critics whose fundamental premises and aims are in sharp opposition to ours. . . .¹⁴

So we gather from this that the differences are fundamental, but again he does not tell us what is the fundamental of the process that he advocates. There follows from this a long dissertation upon education in Greece. There he found liberal education was for the few and that "vocational and practical education was illiberal in Greece because it was the training of a servile class."¹⁵

In my studies of Greece I do not remember meeting an instance in which vocational training was any different in principle from that which pertains today. Whether it were given to the free boy or the slave, it was just as liberal or illiberal for the one as the other, except, perhaps, in the case of shackled slaves—for example, those who worked in the Laurion mines and other undertakings where chained labor was used. Everything connected with the household, with the marketplace, or with the shop, the smithy and the dockyards was learned empirically under something like the apprentice system. I have before me a list of the prices that slaves fetched, and in nearly every case I find that they were fitted for some pursuit. What were called slaves of luxury were expensive. An ordinary mechanic, however, could be had for less than twenty dollars. A slave who possessed any special accomplishments would bring one hundred dollars. Cooks and flute players could be hired at eighteen cents a day. A singer was once sold for twenty-five dollars, and a schoolmaster, or grammarian, once brought as high as eighty-five dollars.¹⁶

These people were lodged and fed and, in most cases, received every attention because they were as valuable as useful animals. Indeed, it may be said that in a general way they were cared for as well as the Negroes of the South before the Civil War. But in Greece they had none of the wage slavery under which the workers today suffer.

And that reminds me of another superstition—the vote as a talisman of emancipation. It may be worth while pointing out that the difference in the vocational training of the Greek and the modern youth can be easily recognized in contemplating a photograph of the Acropolis and then turn-

¹⁴ *Ibid.*

¹⁵ *Ibid.*, p. 156.

¹⁶ W. Romaine Paterson, "The Nemesis of Nations," London, J. M. Dent & Co., 1907, p. 190.

ing to one of the skyscrapers of New York. Phidias, when he built the Parthenon, must have had at his command hundreds of youths who were highly trained. Be that as it may, vocational training is no new branch of learning.

V

I AM AT A LOSS to understand how such a student as Dr. Dewey could misconstrue the efforts of the Greeks and the attempts of the medievalists to apply the laws of reason to supernatural problems. He says:

. . . According to Greek science the subjects of science were profoundly natural and inherently reasonable. According to medieval theological philosophy, the basis of all ultimate moral principles is supernatural—not merely above nature and reason, but so far beyond the scope of the latter that they must be miraculously revealed and sustained.¹⁷

Here he contrasts two entirely different subjects: Greek science and medieval theological philosophy. He does not contrast Greek science and medieval science or Greek theological philosophy with that of the Middle Ages. Why? Because he must score a point for "reason."

When, years ago, I read Nietzsche's essay on "Early Greek Philosophy,"¹⁸ I was startled by the statement that these Greeks "discovered the *typical philosopher's genius*, and the inventions of all posterity have added nothing essential."¹⁹ That was written in the seventies, and I think I may say that all the great scientists since that time would agree. But to me science had begun with Newton, and the classical world was unknown. Imagine, then, my surprise when I read:

Every nation is put to shame if one points out such a wonderfully idealised company of philosophers as that of the early Greek masters, Thales, Anaximander, Heraclitus, Parmenides, Anaxagoras, Empedocles, Democritus and Socrates. . . .²⁰

This so fired my desire for knowledge that I devoted much of my leisure to a study of Greek philosophy. And when, in the nineties, I became acquainted with John Burnet, I began to realize the value of the essay Nietzsche had written nearly twenty years before Burnet published his "Early Greek Philosophy."²¹

In dealing with the Ionians, Burnet says:

. . . They were in search of something more primary than the opposites, something which persisted through all change, and ceased to exist in one

¹⁷ *Loc. cit.*, p. 182.

¹⁸ Trans. by Maximilian A. Mügge, London & Edinburgh, T. N. Foulis, 1911.

¹⁹ *Ibid.*, pp. 78-9.

²⁰ *Ibid.*, p. 79.

²¹ London, A. & C. Black, 1892.

form only to reappear in another. That this was really the spirit in which they entered on their quest is shown by the fact that they spoke of this something as "ageless" and "deathless."²²

It would be an illuminating experience for the moderns if someone gathered together the findings of John Burnet, who is recognized as the authority on the early Greek philosophers. Indeed, his is the only English work in our time which has been translated into German and into French and has achieved a fourth edition in Great Britain. Whether this be done or not, I must point out that Burnet, in reviewing the Milesian School, tells us:

Science, then, became a religion, and to that extent it is true that philosophy was influenced by religion. It would be wrong, however, to suppose that even now philosophy took over any particular doctrines from religion. The religious revival implied, we have seen, a new view of the soul, and we might expect to find that it profoundly influenced the teaching of philosophers on that subject. . . .²³

When we compare the findings of Nietzsche and Burnet with the statement made by Dr. Dewey, which is quoted above, there appears an extraordinary conflict of interpretation. Dr. Dewey says: "According to Greek science the subjects of science were profoundly natural and inherently reasonable." Is the quest for the "ageless" and the "deathless" "profoundly natural and inherently reasonable"? Would Dr. Dewey concede that the interest of the Greek philosophers in the soul called forth the exercise of their reason? Surely it is evident that Dr. Dewey and John Burnet have totally different ideas of what the Greek philosophers meant to science.

Furthermore, it is not quite fair to assert dogmatically that "according to medieval theological philosophy, the basis of all ultimate moral principles is supernatural—not merely above nature and reason, but so far beyond the scope of the latter that they must be miraculously revealed and sustained." Here the learned doctor is poles apart in understanding from our moderns, such as Etienne Gilson,²⁴ who have revealed the medieval philosophers and scientists in an entirely new light. Not one would agree with Dr. Dewey. Indeed, they point out that the medievalist, from the time of Erigena to the end of the period of the Nominalists, claimed reason was the essential for elucidating thought. But perhaps Dr. Dewey would say that a philosopher who deals with the supernatural does not use his reason. These defects in the article with which I am dealing should be cleared up by the

²² *Ibid.*, p. 9.

²³ *Ibid.*, p. 83.

²⁴ "The Spirit of Mediaeval Philosophy," trans. by A. H. C. Downes, New York, Charles Scribner's Sons, 1936.

“progressives” because, when they attempt to liberalize the technicians and the vocationalists, they will be obliged to consider all these matters which engaged the attention of the philosophers before the so-called “scientific method” was advocated in place of the literary pursuits that were found in the channels opened by the liberal arts.

I think it would help considerably in solving some of the problems with which the educationists are confronted if the so-called scientists in the schools and universities dropped entirely their references to classical and medieval philosophy. They are all at sea when they launch their notions in these two worlds. That must be obvious to anyone who has taken the trouble to study the periods and to read such a statement as this made by Dr. Dewey:

. . . Historical illiteracy is thus the outstanding trait of those critics who urge return to the ideas of the Greek-medieval period as if the ideas of the two ages were the same because philosophers of the medieval period used some of the verbal formulas set forth by philosophers of the earlier period.²⁵

This is a very strong statement for anyone to make, because it wipes out the findings of many of the profound students of our time. To mention the men of this period whom such a denunciation sweeps out of philosophical existence would be to name many of the deepest thinkers. For Dr. Dewey must refer to those who urge *a return to the study of the ideas of the Greek-medieval period*. As the charge stands, it is meaningless. “Historical illiteracy” lies not with those *real* “critics who urge a return to [*the study of*] the ideas of the Greek-medieval period,” but is shown in the many writings of the men who advocate the “scientific method” for the liberalization of mechanics.

When Dr. Dewey is hard pressed to score a point against his imaginary opponents, he resorts to the dialectical trick of contrasting two subjects of different realms, for example: human nature and the external world. No scientist would stoop to such a method in serious controversy. Dr. Dewey says:

. . . Belief in the eternal uniformity of human nature is thus the surviving remnant of a belief once universally held about the heavens and about all living creatures. Scientific method and conclusions have had little effect upon persons whose education is predominantly literary. *Otherwise they would not continue to assert in one field a belief that science has abandoned everywhere else.*

The group in question does not, however, oppose the teaching of science. Far from it. Their claim is that the subject matter of natural science is

²⁵ *Loc. cit.*, p. 157.

of subordinate importance; and that, when all is said and done, it belongs with the subjects whose value is technical, utilitarian, practical. Thereby they endorse and tend to confirm the split between natural means of authentic knowing, on the one hand, and everything having moral, ideal, and "spiritual" importance, on the other.²⁶ (*italics mine*)

However, let us tolerate, for the moment, the obvious trick, and have regard to the assertion in italics. I hope to show that Dr. Dewey is quite mistaken in this view and that he has no proper authority for making such a statement. Furthermore, it may be asked if Dr. Dewey really believes that anything in the realm of science has changed human nature. Does he imagine the speed and flying height of the airplane has changed the subsistence needs and desires of the crew? Has the sinking depth and cruising range of the submarine in any way changed the human nature of the engineers and the sailors? Surely the world-wide manifestations of human nature now at work differ only in greater destructive prowess and a grave diminution of the powers of reason. At bottom there is no difference in respect of the characteristics of human nature between us and the human nature manifested in the days of Archimedes, who thought so little of his mechanical achievements that he left no written list of them because he considered them beneath the dignity of a scientist.

VI

DR. DEWEY'S HORROR of looking back amuses me because he does not seem to realize that, at his best, he is the product of the past. He could not live and move and have his being without the tradition that brought him forth. I suppose it is all very well to have one's eye fixed upon the future if vision can penetrate the density of the fog in which we live, but I see no valid reason why Dr. Dewey should not take a look back now for the purpose of picking up again some of the best threads of the tradition we have carelessly dropped during the past fifty years. He says:

The problem of going ahead instead of going back is then a problem of liberalizing our technical and vocational education. The average worker has little or no awareness of the scientific processes embodied in the work he carries on. What he does is often to him routine and mechanical. To this extent the diagnosis the critics make of present vocational education is correct in too many cases. . . .²⁷

Here he is very conscious of the invidious position in which he has placed himself. Nowhere does he tell us how technical and vocational education can be liberalized. And, it may be asked pertinently, who is to liberalize

²⁶ *Ibid.*, pp. 180, 182.

²⁷ *Ibid.*, p. 156.

the young technicians and the vocational students? No educational genius has come forward to say how this is to be done unless the colleges and universities go back to the liberal arts and resuscitate the elementary branches of learning which were considered essential in Europe's systems of education for at least one thousand years, and were tried and tested by the greatest minds of Christendom.

There are sections of Dr. Dewey's article in *Fortune* that I fail to understand, no matter how hard I try to comprehend what is in his mind. Many times during the past twenty years, in reading his books and articles, I have felt that he was chasing an *ignis fatuus*. His extraordinary aversion to religious superstition, to the cleric, and to the "Scriptures" (which he puts in quotation marks), is most amusing in one sense but lamentable in that he ignores the work that has been done by anthropologists and archaeologists in recent years on what may be termed Bible history. How any man who pretends to intellectual attainment can ignore the work of Sir Leonard Woolley and John Garstang—to mention two world-renowned archaeologists—is something that I cannot understand, for even the thoroughgoing advocate of technical and vocational training must realize that we cannot dispense with history when it is examined by experts any more than we can dispense with the knowledge of the indeterminate electron. The expert historian is surely to be reckoned as a scientist and, as for the archaeologist, there can be no doubt in any thoughtful person's mind that his work is scientific.

I am afraid that Dr. Dewey is addicted to the habit of setting up straw figures to be demolished at will. I know no men today who advocate the restitution of the liberal arts in colleges and universities, who do not realize that technical and vocational training are necessary for promising youths. But this does not mean that a university should be cluttered up with affairs that were taken in their stride under the old system and left to the only practical manner of teaching them, the system of apprenticeship to the various trades.

VII

NOW TO COME to the great observation of Dr. Dewey. He is one who spells science with a capital "S," and his faith in it amounts to a superstition that is unpardonable in this day. How he has managed to get himself tangled up in an almost inextricable web of odd notions about science and its wonders is a mystery. He says:

The reactionary movement is dangerous (or would be if it made serious headway) because *it ignores and in effect denies the principle of experi-*

mental inquiry and firsthand observation that is the lifeblood of the entire advance made in the sciences—an advance so marvelous that the progress in knowledge made in uncounted previous millenniums is almost nothing in comparison. It is natural enough that the chief advocates of the scholastic reaction should be literary men with defective scientific educations, or else theologians who are convinced in advance of the existence of a supernaturally founded and directed Institution, whose official utterances rank as fixed and final truths because they are beyond the scope of human injury and criticism.²⁸ (*italics mine*)

What this has to do with the subject under discussion—technical education and vocational training—is not stated. Can it be that Dr. Dewey is under the impression that reputable men in education who wish to restore the liberal arts are in a conspiracy to rule the sciences out of the curricula in the colleges and universities? I do not know one man with whom I have discussed the matter of the restoration of the liberal arts, who is so foolish as to think the sciences can be denied their proper place in an institution of learning. They got along together very well indeed for hundreds of years when the liberal arts formed the basis of the system of education, and there is no reason why they should not do so now. But is there one scientist of world repute, who can be named by Dr. Dewey, who holds such notions as he has set down in this article? There is not one, and I think I cannot do better than present our learned friend with the views of some of the great men of today.

In my library I have many books written by the chief scientists of our time and dozens of other works, which are in the nature of commentaries upon the findings of the scientists. There are volumes by physicists, astronomers, biologists, and chemists. To refresh my memory I have spent several hours, since reading Dr. Dewey's article in *Fortune*, reviewing my markings and marginal notes, and I have not discovered a single instance of a practicing scientist enunciating such thoughts as he has set out in his article on science. In every instance I found passages that revealed the desire to look back and to retrace the steps that were taken from the time of the Greeks down to the Middle Ages, and from there all the way through the centuries to this our day. There is one note that is struck by nearly all of the physicists whose names are household words: for the time being science finds itself in a cul-de-sac. Sir James Jeans not so long ago said, "Science had better not make any more pronouncements for the present." And this warning seems to have been taken seriously; during the past five years at least, there has not been a declaration from a real scientist that progress has been made, with the exception of chemistry. It is true that

²⁸ *Ibid.*, p. 157.

further elucidation of the great problems continues, and this is done by processes of rejection of, and, in some cases, addition to, the findings of ten years ago.

VIII

I THINK PROFESSOR WHITEHEAD, in "Science and the Modern World," was the first man of authority to point the inconsistencies of scientific thought in the western world. He said:

. . . A scientific realism, based on mechanism, is conjoined with an unwavering belief in the world of men and of the higher animals as being composed of self-determining organisms. This radical inconsistency at the basis of modern thought accounts for much that is half-hearted and wavering in our civilisation. It would be going too far to say that it distracts thought. It enfeebles it, by reason of the inconsistency lurking in the background. After all, the men of the Middle Ages were in pursuit of an excellency of which we have nearly forgotten the existence. They set before themselves the ideal of the attainment of a harmony of the understanding. We are content with superficial orderings from diverse arbitrary starting-points. . . .²⁹

From this declaration by so eminent a thinker, I take it that Dr. Dewey's horror of looking back is a mere hallucination, a trick that fate has played upon him.

But perhaps he would count Whitehead out of court as a witness and demand a "recognized" scientist to make a statement acceptable to college professors. Here it is: Heisenberg, in "The Physical Principles of the Quantum Theory," tells us:

To mold our thoughts and language to agree with the observed facts of atomic physics is a very difficult task, as it was in the case of the relativity theory. In the case of the latter, it proved advantageous to return to the older philosophical discussions of the problems of space and time. In the same way it is now profitable to review the fundamental discussions, so important for epistemology, of the difficulty of separating the subjective and objective aspects of the world. Many of the abstractions that are characteristic of modern theoretical physics are to be found discussed in the philosophy of past centuries. At that time these abstractions could be disregarded as mere mental exercises by those scientists whose only concern was with reality, but to-day we are compelled by the refinements of experimental art to consider them seriously.³⁰

J. W. N. Sullivan says that when he asked Schroedinger "whether he thought the present great creative activity in science was some sort of substitute for the creative activity, now so sadly lacking, that used to go

²⁹ "Science and the Modern World," New York, The Macmillan Company, 1925, p. 94.

³⁰ *Op. cit.*, Chicago, University of Chicago Press, 1930, p. 62.

into art and religion, he [Schroedinger] replied, with a sort of surprised boredom, that such a view altogether exaggerated the importance of science."³¹ Then he remarked that Schroedinger was rather amused at the logical incoherence of modern physics and at the highly experimental nature of its mathematics. "We get used to theories we don't understand, and forget their contradictions quite cheerfully," Schroedinger remarked. These two men were awarded the Nobel prize for physics, and I think that they should satisfy the "progressives" who are bent upon looking ahead and introducing the "scientific method" for the purpose of liberalizing the work of mechanics.

Let us now turn to Einstein and try to understand what his attitude is toward the ideas expressed by Dr. Dewey. One day when I lunched with him at his home in Berlin, he took me into his workshop, a room so bare of the ordinary equipment of a study that I looked at it in amazement. Immediately it came to my mind that such a thinker does not need to be surrounded with great shelves of volumes, a revolving atlas, and an elaborate writing desk. But in that bare room there were the portraits of three men—Newton, Faraday, and Clerk Maxwell. Moreover, he told me of his admiration for my kinsman, David Hume. Here were instances of looking back with a vengeance. But when I learned that Einstein got more out of Dostoevsky than he did out of science, I began to realize that the physicist is a many-sided man. All people interested in Einstein's life know how much a part of it is music and that he himself plays the piano and the violin. However, there are innumerable works written on his achievements which describe the depth and breadth of his thought.

On another occasion when we dined with a friend at his villa outside Berlin, I found Einstein keen to know what I had gathered of the attitude of the Catholic Church toward his theory of relativity. He knew, of course, that I was not a Catholic, but perhaps he guessed that I followed such matters with deep interest. I reminded him that on a former occasion he had said:

. . . Mathematico-physical and astronomical works have never been attacked by the Papal courts, but, on the contrary, have been much encouraged by them down to the present day. This is abundantly clear from the fact that we can set up a whole list of Brothers of Orders, particularly Jesuits, who have made eminent discoveries in natural science. . . .³²

I could add nothing more to his own statement.

When the sixtieth birthday of Planck was celebrated in May, 1918,

³¹ "Science and Religion" (interviews with Planck, Einstein and Schroedinger) in *The Observer* (London), April 13, 1930.

³² Alexander Moszkowski, "Einstein the Searcher," trans. by Henry L. Brose, London, Methuen & Co., 1921, p. 141.

Einstein made a beautiful address, which I should like to quote at some length if space permitted. In a section which Einstein devoted to the "peculiar, reserved, and lonely men" who have been led into the Temple of Fame, he said:

. . . I agree with Schopenhauer that one of the most powerful motives that attract people to Science and Art is the longing to escape from everyday life with its painful coarseness and unconsoling barrenness, and to break the fetters of their own ever-changing desires. . . .³³

I think, notwithstanding Dr. Dewey's ideas of what science is and scientists are, that most of them would agree with Einstein that science, like religion, is a refuge for men who look upon the human world as a chaos beyond our ordering.

Moreover, Dr. Dewey ignores the magnetic pull of the mysterious. So far as we know, there is not a people upon the earth whose history does not tell of the yearning to understand the unknown. It was Einstein who said:

The most beautiful thing we can experience is the mysterious. It is the source of all true art and science. He to whom this emotion is a stranger, who can no longer pause to wonder and stand rapt in awe, is as good as dead; his eyes are closed.³⁴

IX

IT IS TO MAX PLANCK that we must turn if we really desire to know what the true scientist is seeking. When his six essays, under the title "Where Is Science Going?"³⁵ came to my attention, they captured me at once, and I read the book at one sitting. I wonder what Dr. Dewey will think of the following from the essay, "Is the External World Real?"

. . . No science can rest its foundation on the dependability of single human individuals. And the moment we have made that statement we have taken a step which puts us off the logical pathway of the positivist system. We have followed the call of common sense. We have taken a jump into the metaphysical realm; because we have accepted the hypothesis that sensory perceptions do not of themselves create the physical world around us, but rather that they bring news of another world which lies outside of ours and is entirely independent of us.

And thus we strike out the positivist *als-ob* (As-If) and attribute a higher kind of reality than that of mere description of immediate sensory impressions to the practical discoveries that have been already mentioned—Faraday's, etc. Once we take this step we lift the goal of physical science to a higher level. It is not restricted to the mere description of bare facts

³³ *Ibid.*, p. 58.

³⁴ Quoted in "The Great Design," edited by Frances Mason, New York, The Macmillan Company, 1934, p. 237.

³⁵ New York, W. W. Norton Co., 1932.

of experimental discovery; but it aims at furnishing an ever increasing knowledge of the real outer world around us.

At this point a new epistemological difficulty enters. The basic principle of the positivist theory is that there is no other source of knowledge except within the restricted range of perception through the senses. Now there are two theorems that form together the cardinal hinge on which the whole structure of physical science turns. These theorems are: (1) *There is a real outer world which exists independently of our act of knowing*, and, (2) *The real outer world is not directly knowable*. To a certain degree these two statements are mutually contradictory. And this fact discloses the presence of an irrational or mystic element which adheres to physical science as to every other branch of human knowledge. The knowable realities of nature cannot be exhaustively discovered by any branch of science. This means that science is never in a position completely and exhaustively to explain the problems it has to face. We see in all modern scientific advances that the solution of one problem only unveils the mystery of another. Each hilltop that we reach discloses to us another hilltop beyond. We must accept this as a hard and fast irrefutable fact. And we cannot remove this fact by trying to fall back upon a basis which would restrict the scope of science from the very start merely to the description of sensory experiences. The aim of science is something more. It is an incessant struggle towards a goal which can never be reached. Because the goal is of its very nature unattainable. It is something that is essentially metaphysical and as such is always again and again beyond each achievement.

But if physical science is never to come to an exhaustive knowledge of its object, then does not this seem like reducing all science to a meaningless activity? Not at all. For it is just this striving forward that brings us to the fruits which are always falling into our hands and which are the unfailing sign that we are on the right road and that we are ever and ever drawing nearer to our journey's end. But that journey's end will never be reached, because it is always the still far thing that glimmers in the distance and is unattainable. It is not the possession of truth, but the success which attends the seeking after it, that enriches the seeker and brings happiness to him. This is an acknowledgment made long ago by thinkers of deepest insight, even before Lessing gave it the classic stamp of his famous phrase.³⁶

I should like the "progressives" to tell me frankly if I am to consider seriously this statement from Max Planck, or is it so contrary to all the ideas held by them that it should be cast aside as thought unworthy of a scientist? Here is my difficulty: whom am I to believe—the scientists or the proponents of the "scientific method"? Who should know? Are the men I have quoted "historical illiterates"? Perhaps Dr. Dewey can advise me what I should do in this extraordinary dilemma in which he places me. But this is not all. Planck says:

³⁶ *Ibid.*, pp. 81–3 (italics in the original).

. . . In my opinion the question of the human will has nothing whatsoever to do with the opposition between causal and statistical physics. Its importance is of a much more profound character and is entirely independent of any physical or biological hypothesis.³⁷

This is the statement made by the discoverer of the quantum theory, a scientist honored by his colleagues the world over. A list of the names of the men who have paid tribute to Max Planck would be a long one. It would include Einstein, Niels Bohr, Rutherford, Dirac, Heisenberg, Schroedinger, Compton, and many others. Do these men know what they are doing in lauding Planck and praising his work? As I cannot get in touch with them, owing to the return to chaos, the only avenue of communication left to me is that which leads to the "progressives" who spell science with a capital "S." But this man Planck says the most extraordinary things for a scientist. Take note of this:

Now, in the sight of God all men are equal. Even the most highly gifted geniuses, such as a Goethe or a Mozart, are but as primitive beings the thread of whose innermost thought and most finely spun feelings is like a chain of pearls unrolling in regular succession before His eye. This does not belittle the greatness of great men. But it would be a piece of stupid sacrilege on our part if we were to arrogate to ourselves the power of being able, on the basis of our own studies, to see as clearly as the eye of God sees and to understand as clearly as the Divine Spirit understands.³⁸

The deeper and farther I go into the thought of Planck, the more complex my metaphysical troubles become, because this statement of his is utterly opposed to the ideas that are held by Dr. Dewey. It seems to me that it takes us back to the Middle Ages—perhaps to the time when Erigena wrote "The Division of Nature." Have the scientists become superstitious as the progressives have become atheistic? Does Dr. Dewey know that this same Max Planck said:

There can never be any real opposition between religion and science; for the one is the complement of the other. Every serious and reflective person realizes, I think, that the religious element in his nature must be recognized and cultivated if all the powers of the human soul are to act together in perfect balance and harmony. And indeed it was not by any accident that the greatest thinkers of all ages were also deeply religious souls, even though they made no public show of their religious feeling. It is from the co-operation of the understanding with the will that the finest fruit of philosophy has arisen, namely, the ethical fruit. Science enhances the moral values of life, because it furthers a love of truth and reverence—love of truth displaying itself in the constant endeavor to arrive at a more exact knowledge of the world of mind and matter around us, and reverence,

³⁷ *Ibid.*, p. 102.

³⁸ *Ibid.*, p. 103.

because every advance in knowledge brings us face to face with the mystery of our own being.³⁹

Farther on, he says: "Science as such can never really take the place of religion."⁴⁰

Where, then, is the conflict? It is certainly not to be found in the realm occupied by the physicists and great astronomers. Although they have their differences of opinion—and many of them do not openly avow entire agreement with the pronouncements of Max Planck—still, it is undeniable that the physicists now, as I predicted forty years ago, are standing on the same mat occupied by the metaphysicians.

Surely, then, it is incumbent upon the "progressives" to reconsider the position they have taken. Indeed, it seems to me that they show in much of their writing the necessity for restoring the liberal arts to their proper place in the system of education. No one reveals the need for the old-fashioned type of education so much as they. The "historical illiteracy" mentioned by Dr. Dewey is not to be found in the ranks of scientists. That it is to be found among the mass of laymen is not surprising because, for a full generation, they have received their education from the "progressives."

X

NOTWITHSTANDING THE LENGTHS to which Dr. Dewey carries dialectical comparisons in his arguments, the student of the periods with which he deals should easily be able to detect that he is mixing two entirely different things. He is confusing the subsistent activities of man today with the spiritual yearnings that compel him, if he be intelligent, to look deeply into the mysteries which perplex him (as Einstein would say). In this respect there is no difference whatever between the man of classical days and his fellow of the medieval times. Nor is there any difference between him and the man of today. They all remain what they were—land animals. And it does not matter what changes take place in the so-called scientific processes; man has the same physical desires and needs that he had in the days of Pythagoras and Thomas Aquinas. And so he will have until the end of time, no matter how many gadgets are put upon the market to make things easier for him. No matter how many labor-saving appliances are invented, none of these things gives him the leisure to explore the cravings of the spirit, and he finds it just as hard to make a living today as it was in the time of his grandfather. Many tell me that it is harder and that there is less chance of security. Indeed, the complaint is that a fatigue has stricken the individual worker but that this defect is not to be at-

³⁹ *Ibid.*, pp. 168–9.

⁴⁰ *Ibid.*, p. 219.

tributed to the exertion of his physical labor. It is the spiritual stress he suffers and cannot himself determine. The haunting spectre of poverty is with him always. And no one should know this better than Dr. Dewey.

What, then, is all this pother about? What do the "progressives" mean by their demands that the "scientific method" be introduced into the various branches of education, as they understand it? The methods of the scientist are totally different from anything they recommend. Perhaps it is that Dr. Dewey is not really thinking of scientists at all. It seems to me that what he has in mind are inventors of appliances, manufacturers of machines, and mechanics—people who use the discoveries of scientists for merely commercial purposes. Hence, technical education and vocational training. But for such purposes our schools of technology open their doors and, if there are not enough to take care of the applicants, others may be added, should the demand for them be of sufficient importance. But if the statistics issued during this war may be relied upon, the percentage of young men who have taken advantage of courses in education is comparatively so small that it seems to me a waste of money to add another building to any campus.

This brings me to a matter that has perplexed me all through my adult life—indeed, since I left school. I came into the world in the period when there was scarcely any provision for the education of the children of the working classes. I have visited adult schools to which working people trudged on Sunday mornings to get the only instruction in reading, writing and arithmetic they could find. To these schools went many of the men in the industrial districts of England who became great manufacturers and machinists. There were no "progressives" then, and very little technical education and vocational training.

In reviewing the names of the men who educated themselves and became renowned manufacturers, there are to be found some of England's worthiest citizens. I could name dozens who worked long hours in the factory, journeyed miles on Sunday to an adult school, and who, in middle life, after they had advanced as manufacturers, merchants, and technicians, went to night school and got what Ruskin would call "the best education—that which a man gets for himself."

Perhaps there is no greater fetish than this one of education for what are called "the masses." In the sixty years of my experience in this country I have seen education for the children of the working classes fall into disrepute. At one time we were near the top of the list of educated peoples. Now we have fallen so low that we might well hang our heads in shame.
Chicago, Ill.