Postface

Approaches to the history of Arabic science

MUHSIN MAHDI

PRELIMINARY REMARKS

The present book is devoted to the history of Arabic science. Today, one normally understands science to be modern science, principally 'hard' or 'exact' science and technology, something the Western world possesses and the Arab world covets. The study of Arabic science in the Western world aims at discovering those aspects of Arabic science in which advances were made or which contributed to the rise of modern science; and the study of Arabic science in the Arab world is meant to prepare the way for the appropriation of modern science and technology. In every case, modern science and technology is taken to be the aim of scientific development and the measure by which earlier science is to be judged. History, on the other hand, is thought to be a method used in searching for, collecting, organizing and presenting the Arabic science of the past. Yet history in the manner practised by the authors of this volume is also a modern science that emerged after modern philosophy and science and has undergone various transformations. Its foundations are not always evident and its premises are often not made explicit. Since the contributors to this volume do not go into the question of the *history* of Arabic science as such, it should be useful to reflect on certain aspects of it in this essay.

What, then, is the history of Arabic science – Arabic science and philosophy cannot be separated in the period under discussion without doing violence to each of them; and, generally speaking, 'science' should be understood to include the philosophic sciences in this essay – and how is one to approach it? Why is it that one cannot speak of Arabic science without being concerned with its history in particular? How do the sciences practised by the Arabs become part of the history of science? How are

'history' and 'science' joined together in this volume? In the absence of an adequate historiography of the history of Arabic science, a preliminary typology of approaches may prove useful.

In the Arab world, widespread interest in the history of Arabic science is mainly due to the special status of modern science and the perception that modern science must be acquired if the third world is to modernize itself; the fact that Arabic science existed in the past is meant to prove that the acquisition of modern science is at least possible. In the West, the relative neglect of the history of Arabic science is part of the neglect of the history of science in general. (The attitude toward the history of science prevalent among professional philosophers in Anglo-Saxon countries and on the Continent, and among their disciples in the Arab world, reflects two significant trends in modern Western thought – positivism and historicism – that will be discussed later on in this essay.) As one looks into the practice of departments of history of science, when they exist at all, and departments of philosophy at Anglo-Saxon universities, one gets the impression that none of this history is truly relevant to the study or understanding of modern science and modern philosophy. In the departments of history of science, the study of modern and contemporary science is emphasized. In most departments of philosophy the history of philosophy is hardly ever taught; it is certainly not a respectable discipline. If you want to study science or philosophy, you do science or philosophy; you do not study the history of science or the history of philosophy, which is not science or philosophy. This is one reason why the history of philosophy – and almost all earlier philosophers were also scientists – has been for all practical purposes banished from philosophy departments in the Anglo-Saxon world.

To the extent that interest in the history of science persists in the Anglo-Saxon world and on the Continent, modern science is viewed not merely as a fact of everyday life, a necessary evolution, a successful revolution or a practically useful instrument, but as a human phenomenon that needs to be clarified and understood within a broader human context. And since the broader human context changes through time or according to cultural situations, the history of science can be interesting in itself and not merely useful for the study of modern science. It is not enough to clarify the concept of science, the logic of science or the language of science as understood and used by modern science itself, or even the social and cultural context of modern science. Interest in history in general, and the history of science in particular, is now justified not for its own sake, as antiquarian interest or for learning the lessons of history, but as a means for understanding the social and cultural context of modern science through a comparative study of the social and cultural context of science in earlier times and in other climes.

The modern histories of Arabic science belong to that trend in modern historical studies which turned away from political history and the history of war and peace (e.g. the *History* of Thucydides) or the history of prophets and kings (the well-known *History* of al-Ṭabarī, for example). In part, it continues the historical tradition that reported the histories of illustrious men, the doxographies and biographies of scientists arranged by nations, generations, schools, specialties (e.g. the works of al-Nadīm, Ibn Juljul, Ṣāʿid al-Andalusī, al-Qifṭī, and Ibn Abī Uṣaybiʿa) and the histories of doctrines and religious sects, such as those by al-Ashʿarī and al-Shahrastānī. The purpose of all these histories appears both simple and defensible. Starting with the information supplied by their predecessors, a number of the leading modern historians of Arabic science collected, organized and presented in a vastly improved form information about the biographies and works of Arab scientists. Modern biographical and bibliographical histories – one thinks mainly of the massive works of George Sarton, Carl Brockelmann and Fuat Sezgin, and the identification and description of manuscripts and printed books on which they rely – provided indispensable tools for the historian of Arabic science.

Another type of writing about science practised in the past was not called history by its authors, yet we tend to call it history today. For instance, in a number of dialogues Plato offers a polemical account of the scientific opinions of pre-Socratic philosophers. At the beginning of the *Metaphysics* and elsewhere, Aristotle gives a retrospective account of the opinions of his predecessors and contemporaries about the principles of the beings. And many Arab scientists, e.g. Ibn Khaldūn, begin their own works with an account of the opinions of their predecessors. Although nowadays we call these accounts histories of science, in fact they are accounts of opinions, restated as prolegomena to the statement of the authors' own opinions about, or clarifications or solutions of, the questions they happen to be treating. They engage in dialectical discussions with their predecessors or contemporaries in order to assure themselves and their readers that the positions they are stating or defending have not been stated already, undermined or refuted by an earlier thinker, or that their predecessors were groping for the truth, took the first steps toward it, or prepared the way for it. Modern philosophers and scientists – Hegel or Renan, for instance – followed this method. Although modern historians of Arabic science are not themselves scientists and therefore do not use this method of writing for the same purpose, any account of past scientific opinion that is not merely a paraphrase or a summary involves this method to some degree and defends a certain view of science and its history.

In modern times we have inherited, principally from Germany, two kinds of general histories of science: history of doctrines (*Dogmengeschichte*) and

history of ideas (*Ideengeschichte*). Histories of doctrines, many of them still in use today, are essentially classificatory. They present paraphrases and summaries of the contents of the works of earlier scientists, with comments and a certain amount of information about their lives and times, arranged according to periods, countries or disciplines. (In France, this kind of history was represented by Charles Renouvier, *Esquisse d'une classification systématique des doctrines philosophiques* (2 vols; 1885, Paris).) Histories of ideas, on the other hand, are concerned with genetic filiations, indebtedness, impact and influence. (In the United States, this kind of history was represented by Arthur Lovejoy, *The Great Chain of Being* 1936, Cambridge, Mass. and by the *Journal of the History of Ideas*.) One studies the same doctrines, but diachronically, and one divides them in a special way, analyzing and reconstructing them for the purpose of bringing out such hidden things as assumptions, unconscious mental habits and the relation between doctrines and the spirit of the age (*Zeitgeist*).

ARABIC SCIENCE AND GREEK SCIENCE

The simplest answer to the question – why history? – is that it is important to understand the genesis of scientific theories. Scientists try to solve certain problems. The proper elaboration of the questions raised, seeing the difficulties involved in the problem and the proposed solution, may require successive efforts of thought. This is what great scientists are engaged in. They see their true predecessors, who may not be their immediate teachers, as having presented a solution, and they see a problem with that solution – a contradiction, a confusion, an inconsistency – and they push this effort a step further. In this sense, there is an internal history of science that cannot be neglected without missing something quite significant. Scientists are not self-enclosed monads, each simply pulling things out of a hat – which is the impression one gets from those histories of science that recount what X says and then what Y says. We are in a way dealing with a kind of necessary history. This is why one cannot move scientists about and reorder them at will, e.g. take Averroes and place him before al-Fārābī or take Kant and place him before Plotinus. One has to figure out, slowly and carefully, why this is the case. Is it merely because Averroes was an Andalusian or a judge, or that Kant was a Prussian or a Christian or a European? Or is it something more than that? Is it possible that Averroes's relation to Ibn Bājja and Ibn Ṭufayl is more important than his relation to al-Fārābī and that Kant's relation to Hume is more important than his relation to Plotinus? Is there a kind of connection that cannot be reversed?

In this context, we must also ask a question – why the Greeks? – that was very much on the mind of a number of Arab scientists in medieval times

and that continues to bother some Arab thinkers today. Why is it that the very word 'philosophy', as Diogenes Laertius says, refuses to be translated into foreign speech? Why does everyone seem to take it for granted that one must start with the Greeks or go back to the Greeks?

There are some who become nervous for the wrong reason when faced with this question. They think that, historically and culturally, the Greeks belong to them; therefore, if anybody else claims he is following the Greeks or knows something about the Greeks, he is trespassing on their private property. There are others who are constitutionally allergic to the Greeks. They feel that the Greeks are the source of all evil in human life: they were rationalists who flattened life and abandoned concern with its inner mysteries. Therefore, to take a stand for the mysterious, the irrational, the unconscious, necessarily involves, they think, the rejection of the Greeks. And since we are now supposed to be investigating a non-Western culture, those who are attracted to non-Western cultures because they are running away from modern rationalism to the mysterious cannot hear someone say that Arabic science had something to do with the Greeks without experiencing a letdown, a cold shower. There were Arab thinkers who argued against Greek logic or metaphysics. They, too, wondered why so many intelligent persons should be concerned with the Greeks, even after the coming down of a new revelation, the true religion, and so many advances in knowledge and technology, including the sciences. What is so special about the Greeks?

One cannot say that the impact of Greek science on Arabic science came about because there was nothing to work against it. If this impact did happen, and in certain respects Greek science did triumph, it was because there was nothing that could stop it, because any effort to understand certain things (including perhaps the human understanding of religion) was of necessity drawn into the problems posed by the Greeks and had to argue these problems in Greek terms, even though these terms had to be modified, or one strand of Greek thought had to be chosen in preference to another – for instance, Plotinus or Proclus or Philiponus rather than Plato or Aristotle. Despite some of our present-day prejudices, we have to consider seriously the proposition that perhaps Greek thought did present what Averroes understood as the natural starting point of all possible human thought. This does not mean that other nations did not create or possess other things – statecraft, technology, drama, music, religion – superior to their Greek counterparts. The question 'why the Greeks?' has to do with scientific thought. The Arab scientists who suggested the proposition I have just stated did not mean that the Greeks had all the solutions, but that the Greeks offered the right framework and possible avenues for pursuing the solution. In order to understand new things (and they knew that there were

many new things – religion, to begin with, in this particular form was new, to say nothing of various new arts), they needed to extend, modify, elaborate and sometimes reject older notions and make a fresh start.

In addition, we need to ask how Arab scientists themselves relate their own thought, implicitly or explicitly, to that of earlier thinkers, how they see their own place in that history, and perhaps also how they see themselves in relation to the future – i.e. what they would like to see come about. We shall need to ask about the role of time in their works: whether their own reflections or researches led them to a linear or cyclical view of the movement of science; whether, for instance, they believed in something like progress or regress in scientific thought, or in social and moral life. One part, but only one part, of this inquiry will be to look at the way in which the Arab scientist perceived of the relation between science and disciplines like theology, mysticism, history and politics, and whether he saw science as belonging to a certain phase in the development of social life in general.

In order to do all this properly, we need to distinguish between what can roughly be called the scholarly and the scientific work proper. In modern science the scholarly work and the scientific work have been largely (if never completely) separated. It is not always easy to make this distinction when reading the works of premodern scientists. But where it can be made, it is helpful for understanding a scientist's view of the history of scientific thought, even though in many cases an Arab scientist tends to present his own work in the guise of a history in which he appears to be stating the opinions of earlier thinkers. In this context, we should develop a certain appreciation for the effort of many Arab scientists to recover earlier thought. Nowadays we have libraries with many millions of volumes. Every significant work exists in the original in many editions, in numerous translations and with many commentaries. And tomorrow any piece of information will be available to anyone who can push a few buttons. We may think, then, that the task of recovering almost any scientific work consists of a short walk to a library or of turning on the computer terminal. Let us not forget that this was not always the case. Under certain conditions in the past, the recovery of the writings of even major scientists and philosophers such as Plato, Aristotle, Ptolemy or Euclid, was a task of major proportions. It required public interest and support, a prosperous and leisurely intelligentsia and above all a great deal of time and effort on the part of translators and interpreters. Even more than this, it required a great deal of rethinking and finding ways to relate the thought of earlier times and foreign nations to contemporary conditions, languages and habits of thought.

As we look at the results of the effort of Arab scientists to restate Greek thought, we need to see if it is possible to distinguish between the work of clarifying and re-presenting the thought of earlier thinkers, on the one

hand, and the work of modifying and extending the earlier doctrines or points of view. These two kinds of activities usually go hand in hand; this is why it is important as one reads these works to look at the points or junctures where an earlier thought is restated, where the restatement ends and where something new takes place. For reasons that are not always evident, these two things are sometimes combined and the distinction between them is not clearly made. The situation would be simple if an Arab scientist were always in the habit of saying, 'This is what Aristotle said and this is what I say.' Somehow, it all usually goes into either 'what Aristotle said' or 'what I say', and we ourselves have to do the work of distinguishing between the two.

SOURCE CRITICISM

If one were to ask in what direction and how far back one needs to go in order to understand the genesis of a scientific concept or premise used by an Arab scientist – whether, for example, one can be satisfied with the immediate source or whether one needs to go to the ultimate source – the answer will obviously depend on the concept or premise in question. It is not enough to say that Arabic science depends on translations or reports of earlier thought: one needs to follow the concepts and premises as far back as practically possible, using available indications of sources. For instance, in the first chapter of the most recent history of Islamic philosophy (Majid Fakhry, *A History of Islamic Philosophy*, 1970, New York), the author suggests that one must begin the study of Islamic philosophy by becoming acquainted with the so-called *Theology of Aristotle* and the so-called *Liber de Causis*, of which he gives a paraphrase for that purpose. It is of course impossible to understand the *Theology of Aristotle* and the *Liber de Causis* without going back to the *Enneads* of Plotinus and the *Elements of Theology* of Proclus. The former are not mere translations or extracts from the latter, but are already new versions in which the earlier works have been modified in a number of significant ways. One cannot see what has been modified – and therefore cannot ask the crucial question as to why – unless one compares the later works with the works from which they were derived. And one cannot stop there; one meets a similar problem with *The Elements of Theology* and the *Enneads*; Hellenistic science, too, is dependent on earlier scientific thought. Plotinus invariably presents his thought in the following manner. The great masters, he would say, are Plato and Aristotle. This is Plato's position; this is Aristotle's position; these are the positions of the Stoics and others; this is the state of the question; and this is how I formulate or solve it. So, again, you do not have a proper starting point;

one has to go back to what al-Fārābī calls the 'two sources' of all philosophy.

A second example will perhaps illustrate better the difficulties involved in certain strands in the current historical approach to source criticism (*Quellenforschung*). A scholar who made significant contributions to clarifying certain aspects in the early history of Arabic science and philosophy (Richard Walzer, *Greek into Arabic*, 1962, Cambridge, Mass., p. 31) states that al-Fārābī's *The Philosophy of Plato* is of great importance 'although it does not reproduce the Greek original in full and omits the ideal doctrine and the immortality of the soul'. But nowhere is it shown how one knows that the presumed Greek original was fuller than what al-Fārābī presents. Nor is it specified whether the presumed Greek original contained the 'ideal doctrine' and the 'immortality of the soul', which al-Fārābī then omitted, either inadvertently or deliberately. Yet the statement asserts that the presumed Greek original did contain the 'ideal doctrine' and the 'immortality of the soul' and that for some reason al-Fārābī omitted them. Now, regardless of the question of the relationship between al-Fārābī's account and the presumed Greek original, it is a fact that al-Fārābī's account omits these two topics from an exposition of Plato's philosophy in which he says explicitly that it is an exposition which is meant to be complete. The question is: what does this omission mean? It is useful to consider what al-Fārābī says about Plato elsewhere.

In *The Harmonization of the Opinions of Plato and Aristotle*, we see that al-Fārābī was very much aware of Plato's 'ideal doctrine' and Plato's view of the 'immortality of the soul' as these doctrines are presented in well-known places in Plato's dialogues. Of course, we can state this fact, too, and yet fail to understand it or relate it to the first fact – i.e. the omission of the two doctrines in question from the account of Plato's philosophy in *The Philosophy of Plato*. But if we try to see the relationship between the statements about these doctrines in the second work and their omission from the first, we must come to the conclusion that the omission from the first was deliberate, and that al-Fārābī did not omit these two doctrines merely because he did not know that Plato spoke about them, or that they are important, or that tradition had considered them characteristically Platonic. However, this is not enough. In order to reach a more conclusive judgment as to which of the two works is meant by al-Fārābī to represent Plato's genuine doctrines or his philosophy proper, we must try to find out whether these two works by al-Fārābī are meant to present the same thing – i.e. the philosophy of Plato. At this point, we notice that in the *Harmonization* al-Fārābī says he plans to give an account of Plato's 'opinions' (*ārā'*), not an account of his 'philosophy' (*falsafa*). We find, further, that this work is throughout much more rhetorical in style and purpose. In *The*

Philosophy of Plato, on the other hand, al-Fārābī is quite insistent on presenting Plato's 'philosophy', the whole of it, and every part of it. The conclusion seems to be this. Al-Fārābī did not consider the 'ideal doctrine' and the 'immortality of the soul' to be parts of Plato's 'philosophy', but to belong to Plato's 'opinions.'

This conclusion does not contradict any hypothesis we may have regarding the presumed Greek original. One may assume that these doctrines were not in the Greek original, and al-Fārābī, satisfied that they were not necessary for an account of Plato's philosophy, did not add them. Or, they did exist and al-Fārābī omitted them because he did not think they belonged to an account of Plato's philosophy as distinguished from an account of his opinions.

To say that al-Fārābī refused to accept the 'ideal doctrine' and the 'immortality of the soul' as belonging to Plato's philosophy proper is, as it were, a new fact, which, again, needs to be understood. We need to learn how al-Fārābī read Plato – whether the Platonic writings themselves or summaries or accounts of them. That is, we need to find out how he understood Plato and how he interpreted Plato. It is also useful to remember how other great philosophers read, understood and interpreted Plato. Aristotle, for instance, seems to have taken Plato's 'ideal doctrine' seriously and tried to refute it, and since Aristotle did not seem to believe in the immortality of the soul, one might conclude that al-Fārābī was trying to understand Plato or interpret Plato in an Aristotelian manner. But this view would be hard to defend because al-Fārābī as well as his readers knew that Aristotle had stated Plato's 'ideal doctrine' and criticized it: al-Fārābī could not have been trying to hide something that people did not know anything about. Again, we may come to the conclusion that al-Fārābī thought that Aristotle was restating or giving an account of what Plato had said, or of Plato's opinions, rather than of Plato's philosophy (Aristotle often attributes such doctrines to Socrates, or some other participant in a Platonic dialogue or to the Platonists, mentioning them by name and referring to those who hold the doctrine of the ideas as a group).

Another way to understand the significance of what al-Fārābī does is to consider the omission in relation to the doctrines of the revealed religions, and especially to Islamic doctrines. Now it is clear that the doctrine of the 'immortality of the soul' in some fashion is basic to Islamic belief. Al-Fārābī's deliberate omission of this doctrine from Plato's philosophy does not seem to be necessitated by the effort to harmonize the doctrines of the philosophers either with religious doctrines in general or the doctrines of a particular religious group or sect with which he may be said to be connected. On the contrary, it would have been more useful for this purpose if he had stated Plato's doctrine of the 'immortality of the soul' and even

perhaps his 'ideal doctrine', which is close to certain theological views about God's attributes. Thus one way to understand al-Fārābī's omission is to say that, according to al-Fārābī, these doctrines were not part of Plato's philosophy, but opinions he held to express his agreement with generally accepted views, the pre-Islamic versions of the Islamic religious views. Al-Fārābī seems to be sharpening the contrast, if not the conflict, that exists between genuine philosophy and generally accepted opinions. The main purpose of these remarks, however, is to show that it is not sufficient to state the fact of an omission and then assume that it was due to historical accident, to some presumed lost Greek original, or to oversight. Statements of fact, such as the fact of an omission, further our understanding only if we make them the starting point of further reflection rather than just holding them up as confirmation of general hypotheses regarding presumed historical dependence.

POSITIVISM AND HISTORICISM

The history of science and philosophy as we know it today is a post-Hegelian phenomenon. In general, it assumes the *completion* of philosophy and the attainment of wisdom (which has been the aim of philosophy since the beginning), by positivism, or Hegel, or historicism, or scientism. All earlier attempts to seek wisdom are viewed through this realized wisdom, i.e. as 'relevant' or 'irrelevant' to this end, each relevant attempt presenting an aspect or stage that was eventually integrated in the final synthesis; or else it is thought that wisdom has been achieved through a new discovery or insight, e.g. cultural relativism, and all earlier science is therefore essentially irrelevant. One must start with the conviction that wisdom is no longer an object of enquiry. But, what if wisdom has not, in fact, been attained by those who have claimed to achieve it in modern times? Or, what if complete wisdom is not possible for humans? What if science is a continuous search for or the love of wisdom? What if love of and search for wisdom is all that a human being is capable of? In that case, both what science is and the nature and use of its history have to be articulated somewhat differently. Finally, every history of science must somehow account for the place of the revealed religions in that history. Hegel integrated the revealed religions into a history of *philosophy* that culminates in atheistic secularism. Whether the revealed religions can be integrated into philosophy or remain an alternative to philosophy has been and continues to be an unresolved question.

In addition to scientists, there are classicists, medievalists and Islamists who are interested in the history of Arabic science. Their approach to it, unlike that of the 'hard' scientist, is to suspend judgement about certain

assumptions of modern science as to what makes for real science and what remains outside the perspective of science. For historical reasons and due to administrative arrangements, these two approaches tend to correspond to the division between the social sciences and the humanities in our universities, and humanists tend to be identified as those who show greater interest in such things as philological competence, broader understanding of the setting or context of Arabic science, and the use of certain indispensable tools of historical scholarship. What is at issue, however, is something else. It is the difference between two theoretical positions regarding what constitutes science or knowledge. Although each consists of a number of strands and the two often overlap, they can be distinguished as positivism and historicism, respectively.

For positivism, the only possible objects of scientific enquiry are facts and relations among facts. The aim of science is to describe and predict so as to ameliorate the human condition: 'Science whence comes prediction; prediction whence comes action', said Auguste Comte. This science is seen as the last stage in the general progress of mankind whose history has been dominated by a progressive evolution that has been universal, unilinear, continuous and necessary. Mathematics and astronomy take pride of place in the classification of the sciences. One need only consider this background to understand the heavy emphasis on the applied mathematical sciences such as astronomy and astrology, determining the times of prayer and the direction of Mecca, and similar subjects, among the students of the history of Arabic science; for it is here that the positivist's concern with description, empirical verifiability, prediction and action, reveals itself.

Beyond this, the modern distinction between science proper – so-called 'hard' or 'exact' science – and the history of science is a consequence of the distinction between science and what is not science, causal science and normative science, empirical science and non-empirical science, science and metaphysics. If one accepts what Aristotle or Averroes called science as truly scientific, one will have to study it as one studies the latest scientific theories – i.e. confront it and try to understand and criticize its claim to be an explanation of nature and experience. In general, the distinction between science and the history of science does not exclude the possibility that earlier scientific theory may have contained a nucleus of truth or contributed to some degree to the emergence of modern or contemporary science. It is, in fact, generally assumed that this was the case; one tries to ascertain to what extent and in what sense Arabic science contributes to modern or contemporary science. This is done on the basis of yet another assumption: that present-day scientific theory (and present-day science in general) is the unquestionable, final standard against which the achievement of earlier science is to be measured. This assumption is also behind the use of current

concepts in the interpretation and evaluation of earlier science, without always asking whether they are meaningful in this context. It is assumed that these concepts will help transform a subject matter which in itself is not scientific or is only partially scientific into the subject matter of a more rigorous science. Thus premodern science, which is thought to have been unhistorical, becomes a legitimate scientific enterprise when it is approached historically in this manner. What contemporary science would like to see is a truly scientific history of scientific theory taking its bearing from the premise that scientific knowledge is possible only about facts and relations between facts, and that everything else, such as 'values', should be studied as facts and related to other facts which can then include on an equal plane the history of scientific institutions, scientific myths and scientific madness (the psychopathological history of scientists in earlier societies).

Historicism emerged out of the distinction between the methods of the natural sciences – 'naturalism' – and the historical sciences as fundamentally different ways of looking at the world. The historical sciences accept the premise that all science is caught up in a process of change. The nature and value of anything is to be assessed by determining its place within a process of development – (hence the genetic model of explanation) – and its place within the larger process or whole of which it is a part (hence the social or cultural context model of explanation). In principle, historicism considers modern science, like premodern science (including Arabic science) to be just another historical event relative to the spirit of its time, developing out of and anchored in certain conditions and cultural contexts. Modern science has no better or worse claim to being scientific or truly theoretical than any earlier science. The distinction between what is scientific and what is prescientific, or between science and philosophy, loses its importance and the distinction between 'theory' and 'history' is no longer tenable. All science is historical, even though most of it is past history and some of it contemporary or current history. Finally, the distinction between facts and values, which is the hallmark of positivism, is considered ultimately untenable. It may be useful in the study of certain limited aspects of historical phenomena. But the reasons for making the distinction are rejected. Most facts cannot be understood without the judgements of value with which they are charged, as it were. It is not true that only facts as facts can be known; values as values can be known as well as, if not much better than, facts. One cannot dispense with understanding values as values in the study of society; there cannot be a thoroughly factual study of society; and science is just one aspect of a society's world view. Even if it were possible to conduct a merely factual study of science, it would be extremely limited, if not trivial; and it would miss things that are absolutely essential for

understanding science and the society of which it is a product. True knowledge of society and science cannot be attained by positivism, but by the science of history or by historical understanding.

In a more positive vein, historicism rejects the distinction between facts and values because it believes that both depend on a comprehensive view or a world view (a *Weltanschauung*) that changes from one society to another and from one period to another. By limiting itself to the study of facts and relations between facts, positivism sticks to part of the surface, as it were, and is not able to penetrate to the origin of these manifestations, which can be properly understood only as manifestations of the comprehensive view that underlies them. These manifestations include values, what people think or believe to be good or true or beautiful, and the articulation of these thoughts in science and art. Values are infinitely more important than facts because they are closer to and express more directly the comprehensive view, the ultimate ground of the culture or civilization or the time. Finally – and this is the crucial initial difference between the positivist and historicist approaches – historicism is based on the premise that values and philosophies and comprehensive views can be known, and can be known scientifically. The only properly scientific knowledge of every aspect of the past and the present, including the scientific knowledge of such things as positivism and contemporary science, hinges on understanding the manifestations of human thought and life in relation to the comprehensive views on which they are based. Modern science, including modern social science, is not the truth and cannot serve as the standard to judge the science of other periods and societies. Like them, it is relative to a particular comprehensive view. The only comprehensive science is the science of history or historical understanding.

Like positivism, historicism tries to solve the difficulty that emerged in the study of man and society as a result of the emancipation of the natural sciences from philosophy and the enormous success of philosophically neutral physics and chemistry. Philosophy is now seen as a sad spectacle of different and incompatible doctrines and schools. There is no hope of resolving these differences or reaching the kind of agreement regarding assumptions, methods, and aims, which is the basis of the program and achievements of modern science. Positivism resolves this difficulty by means of a science of man and society that is philosophically neutral regarding values or judgements of value, the things about which people have disagreed and will continue to disagree. Facts, on the other hand, are thought to be things about which people could agree regardless of their judgments of value. The historicist solution of the same difficulty is theoretically more consistent and radical for two reasons. First, it refuses to sacrifice values and believes that it is possible to develop a philosophically neutral science

of the entire range of the human and social phenomena, including judgements of value. Second, it realizes that the hope for agreement regarding facts is illusory: one needs a science that recognizes the fact of unresolvable disagreement regarding facts as well. As regards judgements of value, this science will overcome disagreements regarding them not by asserting that they cannot be understood as judgments of value but by a peculiar understanding of these judgments of value: by understanding them as relative to comprehensive views and by understanding that these comprehensive views change and differ from one period to another or one culture to another. Greeks, Arabs and Indians did, in fact, disagree regarding what is true or valid. The new historical science will understand the outlook of each group and show that it is relative to a Greek, Arab or Indian world-view, respectively. It will be a single historical science that will enable Greeks, Arabs and Indians to reach equally reliable conclusions, on which they are expected to agree. One may have to make allowances for the weakness of the flesh, the persistence of prescientific prejudices and the possibility of skewing the evidence to serve mundane or sacred purposes. In principle, however, neutral historical knowledge is possible. Deviation from it provides fresh material for further neutral historical studies.

HISTORICAL UNDERSTANDING I

Historical understanding in this sense means understanding all science as relative to something else which in turn pertains to a specific time or society or people. This something may be more concrete than science (such as economic conditions or the political setting) or more general than science (such as the spirit of the time or a particular world-view). In any case, it is not the truth about the nature of man as man or of thinking, but a situation or condition which is historical: it is peculiar to a particular time and place, and has a proper name – Greek, Arabic or Indian. All science is therefore 'true', but true for their setting, and therefore acquire the proper names of their setting. To understand the truth of a particular science requires understanding its setting and its relation to its setting. This historical understanding will show that scientific disagreements, which had seemed unintelligible and arbitrary to positivism, are intelligible and necessary. Their intelligibility and necessity reveal themselves only to historical understanding because it is a historical intelligibility and necessity. All human thought – and this means *all* scientific thought and the very highest principles of theory and practice in science – is relative to specific historical settings. All thought is historical. All truth is historical. The only thought, the only truth, which is not historical, or historically conditioned or relative to a specific historical setting, is the thought that all thought is historical. This

encompasses, explains and reveals the truth of all other thought. It is relative to man as man, to the human condition as such, irrespective of place and time. Historicism thus becomes truly scientific: a science of history in which science, philosophy and history are fused.

The implications of this science of history for the study of the history of science are far-reaching. Premodern (Greek and Arabic) science was the quest of knowledge of all the beings and their principles. It was based on the premise that, in principle, such knowledge is possible. Historicism denies this premise. Science is possible and even necessary, but it is essentially the product or a manifestation (in the form of self-consciousness, ideas and ideals, as well as practical needs) of a specific historical setting, which in one way or another led the scientists to think or believe that their thought, which could not in fact have been about *the* beings or *the* principles of the beings, was about *the* beings and their principles. To understand what this science is really about and see that it is not about *the* beings and their principles, one must engage in historical enquiry. In each case, the historical evidence will prove the historicist contention that the scientific ideas and ideals in question were relative to a specific historical setting. And this, as we have said, applies to all science, past, present, as well as future. Not only was science in its original sense impossible in the past; it is equally impossible today. The student of science must abandon the quest for scientific theory and the application of his own scientific theory to the past. The only scientific theory that is legitimate is a theory about the *history* of science that proceeds from the premise that all scientific theories are relative to their settings.

The difficulty, however, is this. The premise of historicism cannot be proved historically or by historical evidence. Historical evidence may show in every case the relation between a particular scientific theory and whatever its historical setting is considered to be. Even if this is shown conclusively, it may prove nothing more than that this particular scientific theory was the product of its setting or that the particular scientist was very much concerned with solving a particular practical problem under the specific conditions prevalent in a particular time and place. It does not necessarily prove that *all* science is relative to its setting. To prove that a single scientific theory is relative to a specific historical setting is difficult enough. There is absolutely no way in which historical enquiry, no matter how extensive or thorough, can prove that all thought is relative to specific settings. At best historical evidence can show that in this or that case a scientific theory can be shown with some semblance of truth to be relative to a specific setting. But this is by no means sufficient to prove the case for historicism.

To do this, one will have to prove that all scientific thought, past, present and future, is relative to specific historical settings. Historical enquiry

cannot do this or come anywhere close to doing it. As students of premodern science, we must therefore realize that the fundamental premise on which all this research into the history of science is based is neither self-evident nor demonstrated, and that it cannot be demonstrated by the specialized historical enquiries that are based on it. We must also be aware that, for the most part, these historical inquiries are not especially interested in the historical understanding of science; their primary interest is in the sociology of the time in which a particular scientist or group of scientists lived. This kind of sociology is at best a carefully produced hypothetical construct that changes from one decade to another. And the presumed relation between the thought of a scientist and the hypothetical historical setting is at best educated guesswork. This may seem a relatively simplistic way to state the case against historicism, yet I believe it is adequate to cope with almost all the products of historical studies which are based on it.

HISTORICAL UNDERSTANDING II

Positivism and historicism have many things in common. Both are essentially modern, the stepchildren of the distinction between philosophy and the peculiarly modern view of science, and the offspring of the belief in progress and the absolute superiority of modern science and scientific history over all earlier thought. Whatever the range of their interest in the history of science or the labor they expend on it, they share the general modern contempt for the past, especially for earlier thought or understanding, for whatever had claimed to be scientific. Even the proposition that one must first understand earlier thought as its authors meant it to be understood, or that one must understand earlier scientists as they understood themselves, rather than measure them by the standards of one's own thought and time, is accepted and applied freely to the way earlier thinkers understood their past (for instance, to the way Arab scientists understood the Greeks, or Enlightenment or Romantic thinkers understood the Arabs), but never to the way positivism and historicism understand earlier thought.

The contempt for the thought of the past robs us of any incentive to study it, unless it is first transformed into something that serves to confirm us in the truth and finality of our own wisdom. As a result, we have effectively broken the bond that ties us to our past, reshaped it in our own image, and ceased to learn from it. We keep producing historical studies that only confirm our belief that the thought of the past is unimportant in itself, that the history of science is theoretically trivial and uninteresting, and that a serious and creative man of theory need not waste his time on a careful study of past science or expend the effort required to understand the thought of even the greatest earlier scientists as they meant their thought to be understood.

The history of science becomes important and indispensable only if we have reason to doubt that the fundamental premises of modern thought in general, and positivism and historicism in particular, represent the pinnacle of wisdom; that they are the final standard by which to judge all earlier thought and all the thought of other societies; that understanding and the quest for knowledge, the original meaning of science, have come to an end as far as the fundamental premises are concerned; that in principle we now possess that knowledge; and that all that remains has the character of a mopping-up operation or of mere application of proven principles to new data. If we do not doubt any of these things, then we have no reason to be seriously concerned with earlier thought or to complain about the unintelligent and uninspired way in which it is being studied. If, on the other hand, we have reason to doubt that the premises of positivism and historicism are self-evident or demonstrable, or that the claim of modern social science and historical science as the final and true knowledge is established beyond a shadow of doubt, then we must rethink the question of the history of science. If, unlike the positivists and historicists, we are not already in possession of knowledge of all the fundamental issues of human thought, science and philosophy, but only seeking for such knowledge, we must ask whether the history of science is of any use to *us* in this search, and if so how it ought to be approached so as to help *us* as we pursue the search.

In order to do so, we must realize that the history of Arabic science is an impossibility if there are no permanent issues addressed by science, if the fundamental questions or riddles of science are historically relative, or if every age or society lives and moves within a horizon that is fundamentally unique. For in that case science itself would be impossible or absurd; and there cannot be a scientific history of this absurdity. The scientific history of such absurdities as alchemy and astrology presuppose sciences like chemistry or astronomy or psychology, which are not absurd. Science deals with man's ability to know, with what characterizes him and distinguishes him from other beings. To say that this is absurd is to say that the whole of man's life is absurd, defies understanding or is ultimately unintelligible. If this were the case, the scientific historian would have to step outside the whole of man's life and, therefore, outside the whole of human science.

In any case, we need not be dogmatic about this. Let us assume an indeterminate relation between science and history or the period or background that is not science. Let us keep in mind that we need to understand also the scientist's own understanding of this history. But let us above all be open to the possibility that understanding the relation between science on the one hand, and the historical setting on the other, requires that we understand science, not as ideology or superstructure, but as science. We must give earlier science the same benefit of doubt that we give current

science. Simply to assume a historical setting and to proceed rapidly to explain premodern science as causally related to it or as its product, will not take us very far, just as to do this with current science would be unproductive.

We live in times and in societies whose character is largely determined by science, and in which the most important opinions, the ones that form the foundation of social life and dominate its course, are scientific in origin. Significant social and political changes are created by science, and serious social and political problems are solved by science. At a time and in societies for which science is of such great importance, in which science has made such a great impact, and whose origin and development is inconceivable without science, it seems natural to ask questions about the position of science in all ages and societies. What we do not always realize, of course, is that ours is a new situation in which social and political opinions owe their origins, orientation and force to a specific kind of heritage or tradition, that of science.

To clarify and understand our incomplete, fragmentary and incoherent opinions, we must penetrate to their origins and uncover their grounds or roots. There is no better way to do this than to turn to scientists who developed and presented them in a coherent manner. Modern science, unlike earlier science, must engage in the study of earlier science, not merely to learn something about its ancestry, but also to clarify and understand the foundation of contemporary scientific and social opinions. In this sense, the history of science must become a component of the quest for the foundation of science in a way that was not necessary in earlier times. And from this point of view, too, there is a close analogy between modern science and Arabic science. We moderns, too, do not create our basic notions, but develop them as a result of a critique of earlier notions, Greek, Arabic, medieval Western, early modern; and it is important for our self-understanding to know what was modified, rejected or kept. In this respect, the history of Arabic science may throw some light on the general process of appropriating, adapting and criticizing earlier scientific theories. (The study of Arabic science is relevant for us from yet another point of view. Our current attitude to science is no longer unambiguous. We may not believe that modern science, and the philosophy from which it emerged or which provides its background, can be dangerous for our souls, but we most certainly realize now that it can be dangerous to our bodily existence, to the survival of the human race, and perhaps even to the survival of life on earth. This is a problem we need to understand. The medieval venture in general, and the Arabic–Islamic venture with which we are concerned in particular, provides an example of how such fears about the end of our world arise and how they are met.) In general, we cannot understand the

nature of either medieval Arabic or early modern Western science without taking their genesis and respective contexts into account. Similarly, we cannot understand the current situation in the Arab world or in the West and do something about it intellectually without seeing how it emerged and unfolded out of the parent situation or situations. Otherwise, we do not know whether modern science is, as it claims, the final revelation of the truth or only a restricted horizon. And we cannot see this horizon unless we go beyond it and understand its genesis.

The only danger is that we may be charmed by this historical study to believe that, in addition to clarifying our opinions, it will solve our problem, which is the problem of modern science and its relation to society. But this problem is so vast and difficult that we need all the help we can get, and we are helpless unless we first reconcile ourselves to the fact that our progress, inventiveness and achievement do not give a clear and coherent account of themselves. They are grounded in thoughts that deserve to be uncovered and studied carefully and conscientiously. Because of their forward-looking, future-directed character, they either turn us away from this necessary task or else predetermine the outcome of our historical studies so as to whitewash our opinions instead of clarifying their foundation. This is why the question of how to approach the history of science becomes a serious business. For the more history becomes 'scientific', imbued with belief in progress, enlightenment and being on top of the world, and cocksure of its premises and method, the more the blunders, the absurdities and the incompetence in what claims to be understanding, interpretation and criticism of earlier science. We need to find a way out of this vicious circle.