

Science and Technology in Traditional Islam and in the Modern World

Reflections on a Recent Book

by

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Studies in Comparative Religion, Vol. 11, No. 1 (Winter, 1977) © World Wisdom, Inc.
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As regular readers of this journal will already be aware, Seyyed Hossein Nasr is a distinguished scholar who writes with wisdom and clarity on a wide range of Islamic themes. A specialist in the history of science whose academic training was pursued in the United States—first at the Massachusetts Institute of Technology and subsequently at Harvard—he is currently Professor of the History of Science and Philosophy at the University of his native Tehran. His numerous publications have been concerned with diverse aspects of Islamic science, philosophy and mysticism, and more generally with the worldwide spiritual crisis of modern man. All these themes figure in his most recent book, *Islamic Science: An Illustrated Study*, published under the auspices of the World of Islam Festival held in England last year.

Professor Nasr points out in the Preface that the book was written partly to complement the exhibition of “Science and Technology in Islam” mounted at the Science Museum in London as one of the Festival’s main features. Just as the exhibition (itself the conception of Professor Nasr) was the first of its kind ever organized, so is the book “the first ever written on Islamic science in which the study and analysis of the texts is combined with illustrations from sources throughout the Islamic world” (p. xiii). The book also serves to complement an earlier study by Professor Nasr, *Science and Civilization in Islam* (1968), a work similar in scope and spirit but with literary rather than visual illustrations. As we shall see, however, the relevance of the author’s latest book extends far beyond the specifically Islamic sphere.

Given the specialized, not to say narrow, reference of the term ‘science’ in modern usage, the title of this book may be misleading to some. For the book, like the above-mentioned exhibition, deals with applied science and technology and not just with science in its theoretical and speculative aspects; thus the more explicit title given to the exhibition would have been equally appropriate for the book. Furthermore, the term ‘science’ in the book’s title in principal covers not only the natural and physical sciences, but the whole range of human knowledge, including the knowledge of man as a spiritual being. This broader sense of the term ‘science’ is of course the earlier and more traditional one, and it is worth recalling that the Latin terms *scire* and *scientia* implied discernment and discrimination as well as any merely quantitative

knowledge. As regards the actual contents of the book, however, Professor Nasr sensibly avoids any radical deviation from the modern usage of the term 'science,' for otherwise he would have had to include in his discussion architecture, the visual arts, music, literature, calligraphy, and the various domestic arts, as well as the specifically religious and philosophical sciences, all of which were in fact covered in other publications and exhibitions of the Festival. And yet the Islamic sciences, "even in the more limited sense considered here... are concerned at once with the world of nature, of the psyche and of mathematics. Because of their symbolic quality, they are also intimately related to metaphysics, gnosis and art, and because of their practical import they touch upon the social and economic life of the community and the Divine Law which governs Islamic society' (p. xiii). Thus, while the plural title 'Islamic sciences' might have helped to convey the broader sense of science intended by the author, the chief advantage of the singular term is that it focuses the fact, emphasized throughout this book, that in traditional Islam the various sciences constitute a hierarchically ordered and organically unified whole.

The book falls into five parts of two or three chapters each; but the overall structure resembles that of a triptych. Parts Two to Four which constitute the main body of the book, contain chapters on the particular Islamic sciences: cosmology, cosmography and geography, and the various branches of natural history; mathematics, astronomy and astrology, and physics; medicine and pharmacology, alchemy, and agriculture and irrigation. These middle chapters of the book are balanced on the one hand by introductory chapters dealing with the rise of the Islamic sciences and the Islamic educational system (Part One), and on the other by chapters dealing with man's place in the natural environment and in the cosmic order (Part Five). Because Professor Nasr has taken care to emphasize throughout the book the fundamental ethos and basis of Islamic science, the various parts and chapters can be read in almost any order, or treated as virtually self-contained essays, while the well-organized text and meticulously detailed index allow the book to be used equally well as a work of reference. The text itself is lucid and straightforward, with bibliographical details and supplementary information confined to readily accessible notes at the foot of the page. The text is illustrated throughout with color plates, monochrome photographs and various charts and diagrams. Notes to the illustrations, a glossary of Islamic terms, and a select bibliography of relevant works in European languages appear at the end of the book. The excellent color plates are mostly the work of the French photographer Roland Michaud, who was also responsible for those illustrating the book's companion volume, Titus Burckhardt's *Art of Islam*.

Considering the vast complexity of Islamic science and technology, it is impressive how much information Professor Nasr has managed to include, without undue compression or oversimplification, in what does not claim to be anything more than a general survey of the subject. On the other hand, the detailed network of information is never allowed to obscure the points of overall importance. Of these perhaps the most significant is the fact that the development of Islamic science and technology was closely bound up with the principles and practices of Islam as a specifically religious tradition. Professor Nasr stresses in particular the

fundamental role of the Quran and the *Hadith* in this development. “The Quran and the *Hadith* together are the fountainhead of all that is Islamic in whatever domain it might be,” and in particular “a whole metaphysics and cosmology have issued from the bosom of the Quran and the *Hadith* and have acted as the basis upon which all the Islamic sciences have been constructed” (p. 5). The metaphysically oriented cosmology of Islam thus provides the proper starting point for the study and interpretation of the entire history of Islamic sciences. “No understanding of the Islamic sciences or for that matter the sciences of any other tradition is possible without a consideration of the cosmology to which the branches of the traditional sciences are related like so many limbs belonging to a living organism” (p. 27). And if cosmology be likened to a tree whose separate branches are the various sciences, then the roots of this tree “are in turn sunk in the ground of the metaphysical principles which provide the tree with its life force” (p. 236).

On a more specific level, the book allows one to reflect on the ways in which the various branches of Islamic science had a practical basis in the realities of the life of Islam. The interest in geography and natural history was inevitably stimulated by the expansion of Islam into the different areas of Africa, Europe, and Asia, just as the special skills in agriculture and irrigation were responses to the difficulties of climate and terrain throughout much of the Islamic world. Nearer to the heart of Islam, the development of mathematics and astronomy was in part stimulated by the need to calculate the times and direction of daily prayer and the progression of the lunar calendar. Traditional medicine and pharmacology, too, were intimately bound up with the faith and practice of Islam, not only through injunctions relating to hygiene, ablution and diet, but also in the mystical and alchemical doctrines concerning the relationship between the spiritual, psychic and physical levels of man’s being. Naturally the Islamic sciences did not spring fully armed from the principles and practices which necessitated and justified them. And here medicine provides a particularly instructive example. “From the metaphysical and cosmological points of view, the principles of Islamic medicine are deeply rooted in the Islamic tradition, although the medicine itself came into being as a result of the integration by Muslims of several other traditions of medicine of which the most important was the Greek” (p. 154). “In the same way that in mathematics the central Islamic doctrine of unity (*al-tawhid*) and its applications accorded with the Pythagorean philosophy of numbers and made the integration of Greek mathematics into the Islamic perspective possible, another basic Islamic doctrine, namely that of harmony and balance, made the philosophy underlying the Hippocratic and Galenic traditions easily digestible by Muslims” (p. 153).

These observations by Professor Nasr underline a second fundamental point which emerges from his account of the Islamic sciences. For if these sciences cannot properly be understood without reference to the metaphysical cosmology which constitutes their unifying ground, it is equally important to view the Islamic scientific achievement in its historical and cultural perspective. “Islamic science came into being from a wedding between the spirit that issued from the Quranic revelation and the existing sciences of various civilizations which Islam inherited

and which it transmuted through its spiritual power into a new substance, at once different from and continuous with what had existed before it” (p. 9). This statement is typical of the spirit of the book as a whole. Professor Nasr is both a dedicated Muslim and a distinguished scholar, but he is prey neither to the partisan tendency to minimize what Islam owes to other cultures, nor to the academic disease of reducing the integral uniqueness of a civilization to a set of historical contingencies. As Professor Nasr’s study makes abundantly clear, the Islamic achievement in science combined the creative and critical application of what had been inherited with a whole range of new discoveries and inventions.

One prejudice completely disarmed by Professor Nasr’s study is the commonly held view that science and technology are rather dull and difficult subjects for the layman. And yet the value of this book is far from being exhausted by its excellence as a clear and exciting introduction to a dimension of Islam that deserves greater attention from laymen and specialist alike. For, it contains a message which demands the attention of all who are troubled by the spiritual and material crisis of the modern world. Throughout the book we are reminded of the contrast between the metaphysically disciplined nature of Islamic science on the one hand and the spiritually bankrupt character of modern science on the other. A crucial factor in the contrast is that Islamic science, being integrated with a spiritual vision of man, recognized that certain boundaries to scientific and technological development were implicit in this vision. Many people today, for whom modern western technology represents the supreme fulfillment of the technology of all previous ages, will doubtless find it hard to believe, for instance, that although certain Islamic treatises “described complicated machines which are most like what modern technology has developed during the past two centuries... it was precisely this kind of technology which the Muslims never took seriously as a possible way of changing their economic life and means of production,” the only real practical outcome of such treatises being “the making of complicated clocks and gadgets as if the Muslims wanted to show that the only safe kind of complicated machine is a toy” (p. 147). Another example is provided by the Muslim attitude to printing. The historian of science Lynn White Jr. suggests that the Muslims deliberately avoided the printing press because they felt instinctively that cheap books would eventually destroy cultural leadership, and in his opinion the later history of the West has proved their instincts were correct. The ancient Chinese, whose immense scientific knowledge and technical expertise are now fully recognized, likewise refrained from certain technological applications well within their competence because they saw in them a threat to the quality of their way of life. The same is true of the Ancient Greeks; for, as Simone Weil observed, if Greek science produced little in the way of technical applications, this was not because they were incapable of doing so, but because the wise men of the times “feared the effects of technical inventions which could be made use of by tyrants and conquerors. So, instead of delivering to the public the greatest possible number of technical discoveries and selling them to the highest bidder, they kept rigorously secret all the ones they happened to make for their own amusement; and, apparently, themselves remained poor” (*The Need for Roots*, p. 234). In modern science by

contrast, it is taken as axiomatic that every possible avenue of scientific knowledge should be explored and each new scientific discovery exploited to the full technologically. The mentality is that of twentieth-century Faust: “Wherever he sees an avenue, he will explore it—regardless of the triviality or the disaster to which it leads; wherever he sees the chance of a new departure, he will take it—regardless of the desolation left behind. He is so unsure of what *ought* to be known that he has come to embrace a preposterous superstition: everything that *can* be known is also *worth* knowing—including the manifestly worthless.... Galley slaves of the free mind’s aimless voyaging, we mistake our unrestrainable curiosity, the alarming symptom of spiritual tedium, for scientific passion. Most of that which flourishes in these days as ‘science,’ said Kierkegaard, is not science but indiscretion...” (Erich Heller, *The Artists Journey to the Interior and other essays*, pp. 15-16).

To modern man the idea that certain limits should be observed in the development of science and technology can only mean an arbitrary restriction of his natural freedom. But the questions of what is truly natural in man and what constitutes his true freedom are metaphysical ones and they cannot be answered in a circular manner, through the mere observation and analysis of man as he actually thinks and behaves. Modern psychological and sociological theories of what is ‘natural’ in man and ‘liberating’ for him, because they lack any metaphysical basis, inevitably turn out to be nothing more than projections of that perennial complex of desires and illusions from which man in his heart longs to escape. These desires and illusions may have become man’s ‘second nature’ but they do not constitute his essential nature. Thus the belief that modern science can define the true nature of man and that technology can lead him out of the present crisis appear, from a traditional perspective, as a perverted quest for metaphysical truth and transcendence in a direction where they simply cannot be found. “The individual who lives in the technical milieu knows very well that there is nothing spiritual anywhere. But man cannot live without the sacred. He therefore transfers his sense of the sacred to the very thing which has destroyed its former object: to technique itself. In the world in which we live, technique has become the essential mystery...” (Jacques Ellul, *The Technological Society*, p. 143). The Islamic sciences, by contrast, “never sought to satisfy the thirst for the infinite in the realm of the finite. They were based directly on metaphysics and made no claims to usurp its place. They presented a ‘finite science’ of the finite and the relative domain of reality and left the quest for the Infinite and the Absolute to metaphysics and gnosis which alone can satisfy this thirst in a real manner” (Nasr, p. 237). In view of the narrower sense of the term ‘science’ noted earlier and the conflict between science and religion in recent centuries, the claim that science should not be allowed to usurp the place of metaphysics will easily be misconstrued as the claim that science is something necessarily distinct from and inferior to religion. To the extent that science does usurp the place of metaphysics it does indeed stand in need of subordination to the latter, but any such usurpation, far from being intrinsic to the nature of science, must at the same time be recognized as a betrayal of what science itself truly is. From this perspective, then, modern science and the ‘scientism’ that accompanies it will be viewed not as a new or improved form of science,

liberated from the restrictions imposed upon it in earlier ages, but as a betrayal of its universal and essential nature. And hence the future of science, and of man himself, depends on the extent to which the authenticity which science had in previous ages can be recovered.

The essentially inauthentic nature of modern science, especially as contrasted with the traditional Greek science of which it is historically the direct betrayal, has been perceptively analyzed by the French writer Simone Weil. Her comments run parallel with many of the observations made by Professor Nasr. "Science, art and religion," she writes, "are connected together through the notion of *order of the world*, which we have completely lost" (*Notebooks*, vol. I, p. 248); "science, art, and the search for God were united for the Greeks and they are separate for us" (*On Science, Necessity and the Love of God*, p. 48). "Today, we cannot imagine that the same man could be a scientist and a mystic except at different times in his life. If a scientist has some leaning towards art or religion it is kept absolutely separate from his main occupation, or if he tries to connect the two he does it, as we know from more than one example, by vague and significantly banal common-places. Similarly, during the last three centuries men concerned with art or religion have not dreamt of taking an interest in science..." (*ibid*, p. 47). Another French writer, Jacques Ellul, makes essentially the same point. "We are forced to conclude that our scientists are incapable of any but the emptiest platitudes when they stray from their specialties.... Particularly disquieting is the gap between the enormous power they wield and their critical ability, which must be estimated as null. To wield power well entails a certain faculty of criticism, discrimination, judgment, and option. It is impossible to have confidence in men who apparently lack these faculties. Yet it is apparently our fate to be facing a "golden age" in the power of sorcerers who are totally blind to the meaning of the human adventure" (*The Technological Society*, p. 435). And yet, as Simone Weil observes, the true aim of the man of knowledge should surely be "the union of his own mind with the mysterious wisdom eternally inscribed in the universe. That being so, how should there be any opposition or even separation between the spirit of science and that of religion? Scientific investigation is simply a form of religious contemplation" (*The Need for Roots*, p. 250).

From Professor Nasr's study it is clear that the Muslims, like the Greeks before, them, regarded science as ultimately a religious subject. Of course the particular nature and circumstances of the Islamic civilization meant that the Muslims produced far more technical applications of their knowledge than the Greeks did of theirs; but the important point is that, like the Greeks, they never allowed sciences to be indiscriminately exploited by technology in the way that has become the accepted norm in the modern world. In this connection it is worth recalling some facts frequently overlooked by both critics and apologists of modern culture. In the first place it must be remembered that science, as a method of observation, experimentation and interpretation, is not an invention of modern culture; what is characteristic of modern culture is the narrowing down of the field of science and the development of a 'scientism' which interprets the data of science in accordance with a materialism which is imposed upon rather than derived from this data. Secondly, the modern world cannot claim to have invented technology

either, let alone to have perfected it. Not only does technology have a history quite as ancient as that of science, but until comparatively recent times technology followed a course of development more or less independent of that of science. The popular view of technology as a secondary outgrowth of science, dependent for its development on new scientific theory and discovery, is in fact quite mistaken. Right up into the middle of the nineteenth century the actual links between science and technology were very tenuous; if anything, the influence of technology on science was more significant than that of science on technology. Lynne White Jr. has aptly described the history of technology as ‘a record of inspired empiricism,’ and this empiricism embodied laws and principles that were not necessarily understood ‘scientifically’ by those who invented and developed it. Nor was the virtual separation of science and technology either unfortunate or fortuitous. Technology so long as it was independent of science remained geared to and controlled by human needs; once linked up with science it began to get out of hand—literally—and to exceed the human scale, subjugating the human needs it formerly served, and destroying the environment with which it was once in harmony. So it is neither science nor technology which is responsible for the crisis of the modern world, but rather the *scientific technology* that has resulted from the unholy combination of these once virtually separate human activities.

Whatever immediate comforts and advantages modern scientific technology may have brought about, these have been increasingly overshadowed by the two negative consequences of this technology: on the one hand the large-scale destruction or pollution of the natural environment, and on the other the equally devastating effects of mass technology on the quality and integrity of human life itself, both socially and at the individual level. With regard to the second consequence, it has of course become a truism, and even part of the stock language of scientific humanism, to say that our way of life is too materialistic and that we must devote more attention to man’s ‘spiritual’ needs. But what is meant by ‘spiritual’ in this context usually turns out not to differ essentially from what is recognized as ‘materialistic’ by the same criteria. The general belief still obtains that man’s sufferings and anxieties can eventually be reduced, if not removed altogether, through some yet undiscovered reorganization of the present social and technological system. In other words, the ecological and social crisis of the modern world continues to be taken at its face value rather than recognized as being essentially a cosmological and spiritual one. This failure to trace the crisis to its roots is of course an inevitable symptom of the crisis itself. Certainly we cannot ignore the need for social and technological reforms, but these reforms will come to nothing unless they are rooted in a true metaphysical understanding of man’s nature and place in the cosmos.

Professor Nasr believes that a study of the traditional science and technology of Islam could help man in the modern West to recover a proper view of the relationship between man and nature so necessary to his self-understanding and survival, and that it would also help Muslims themselves to avoid the worst errors accruing from the rapid and uncritical adoption of modern western technology. There is already in the West a small but growing number of critics who urge

the development or recovery of forms of small-scale technology which, like those of traditional Islam, utilize the earth's natural forces and resources, "making the maximum use of human skills and causing the minimum amount of disturbance within the natural environment" (Nasr, p. 147). However impractical and idealistic may seem the idea of initiating such forms of technology on any significant scale at this stage in our history, there can be little doubt that they constitute a logically and morally acceptable alternative to the massively wasteful and destructive technology on which we are presently dependent. Most human societies throughout history have lived by small-scale technology, including highly cultured and civilized societies like that of Islam. Fundamental to Islamic technology was the idea of ecological equilibrium. "Both Islamic science and its applications convey to those who are familiar with them a sense of harmony and equilibrium which is, in fact, directly reflected in the actual products of Islamic civilization, whether they be in the field of art in its narrow sense or in technology, agriculture and city planning" (p. 227). Consequently, one of the essential features of Islamic technology is what Professor Nasr calls its "intimate quality," not only because it was "inseparable from art," but more especially because it was "bound to forces and elements innate to the natural environment" and "related to man in a way which is hardly comprehensible to those who identify technology with the modern machine driven by forces alien to the natural environment..." (p. 233). What must be stressed here is that the difference between the small-scale technology of traditional societies and the mass technology of the modern world differs in kind and not merely in degree—a fact easily obscured by the use of the word technology to describe both kinds. Indeed it is only by a kind of courtesy that one can describe modern technology as technology at all, for the Greek word *technos* has as much to do with art as with mechanics and thus strictly speaking applies only to the ethos and aesthetic of small-scale technology.

It is significant that even those who defend modern mass technology tend to view its appearance and manner of operation as necessary evils, as means justifying the ends—descriptions one would hardly think of applying to, say, a windmill or waterwheel. But one's instinctive preference for small-scale technology is not simply an aesthetic or sentimental one; it involves the recognition that this technology, being in close harmony with natural elements and forces, allow the human worker to remain human and to experience in a real and tangible sense the translation of these elements and forces into what is useful and necessary. Modern technology, by its very scale and complexity, cuts man off from any human involvement with the work being done. Nor must it be imagined that a reorganization of modern technology could remove its alienating effect upon the human worker, for the logic of mass technology excludes such a possibility. As Frithjof Schuon reminds us: "To talk about a wise use of machines, of their serving the human spirit, is utterly chimerical. It is in the very nature of mechanization to reduce men to slavery and to devour them entirely, leaving them nothing human, nothing above the animal level, nothing above the collective level.... Man, who created the machine, ends by becoming its creature" (*Spiritual Perspectives and Human Facts*, p. 21).

Jacques Ellul, quoted earlier, has given us a relentless analysis of the inner logic of the

whole technological system, of which machines themselves are only a part. It is worth quoting him at length. "The combination of man and techniques," he writes, "is a happy one only if man has no responsibility. Otherwise, he is ceaselessly tempted to make unpredictable choices and is susceptible to emotional motivations which invalidate the mathematical precision of the machinery. He is also susceptible to fatigue and discouragement... Eliminate the individual, and excellent results ensue... Technique obeys its own specific laws, and every machine obeys laws. Each element of the technical complex follows certain laws determined by its relations with the other elements, and these laws are internal to the system and in no way influenced by external factors. It is not a question of causing the human being to disappear, but of making him capitulate, of inducing him to accommodate himself to techniques and not to experience personal feelings and reactions... When technique enters into the realm of social life, it collides ceaselessly with the human being to the degree that the combination of man and technique is unavoidable, and that technical action necessarily results in a determined result. Technique requires predictability and, no less, exactness of prediction. It is necessary, then, that technique prevails over the human being. For technique, this is a matter of life or death. Technique must reduce man to a technical animal, the king of the slaves of technique. Human caprice crumbles before this necessity; there can be no human autonomy in the face of technical autonomy. The individual must be fashioned by techniques, either negatively (by the techniques of understanding man) or positively (by the adaptation of man to the technical framework), in order to wipe out the blots his personal determination introduces into the perfect design of the organization... The individual who is a servant of technique must be completely unconscious of himself. Without this quality, his reflexes and his inclinations are not properly adapted to technique... The enormous effort required to put this technical civilization into motion supposes that all individual effort is directed toward this goal alone and that all social forces are mobilized to attain the mathematically perfect structure of the edifice... Henceforth it will be wrong for a man to escape this universal effort. It will be inadmissible for any part of the individual not to be integrated in the drive toward 'technicization;' it will be inadmissible that any man even aspire to escape this necessity of the whole society. The individual will no longer be able, materially or spiritually, to disengage himself from society. Materially, he will not be able to release himself because the technical means are so numerous that they invade his whole life and make it impossible for him to escape the collective phenomena. There is no longer an uninhabited place, or any other geographical locale, for the would-be solitary. It is no longer possible to refuse entrance into a community to a highway, a high-tension line, or a dam. It is vain to aspire to live alone when one is obliged to participate in all collective phenomena and to use all the collective's tools, without which it is impossible to earn a bare subsistence. Nothing is gratis any longer in our society; and to live on charity is less and less possible. 'Social advantages' are for the workers alone, not for 'useless mouths.' The solitary is a useless mouth and will have no ration card—up to the day he is transported to a penal colony... The autonomy of technique forbids the man of today to choose his destiny. Doubtless, someone will ask if it has not always been the case that social conditions, environment, manorial oppression, and the family

conditioned man's fate. The answer is, of course, yes. But there is no common denominator between the suppression of ration cards in an authoritarian state and the family pressure of two centuries ago. In the past, when an individual entered into conflict with society, he led a harsh and miserable life which either hardened or broke him. Today the concentration camp and death await him; technique cannot tolerate aberrant activities." (*The Technological Society*, pp. 136-140).

If there really is a difference of kind between small-scale technology on the one hand and modern mass technology on the other, it is obviously crucial for the critic and would-be reformer to identify the difference as clearly and explicitly as possible. The difference would seem to lie in what Coomaraswamy has called the "delicate distinction between the machine and the tool" (*Art and Swadeshi*). He gives an instructive example: "The carpet loom is a tool, a contrivance for holding warp threads at a stretch for the pile to be woven round them by the craftsman's finger's; but the power loom is a machine, and its significance as a destroyer of culture lies in the fact that it does the essentially human part of the work." However subtle this distinction may appear and however difficult to identify in practice, this distinction between the tool and the machine, if it is important at all, must be recognized as an absolute one. Certainly in the modern world man has been progressively abandoning the tool in favor of machinery and technique. Ellul quotes the "celebrated formula" of the philosopher Alain: "Tools, instruments of necessity, instruments that neither lie nor cheat, tools with which necessity can be subjugated by obeying her, without the help of false laws; tools that make it possible to conquer by obeying.' This formula is true of the tool which puts man squarely in contact with a reality that will bear no excuses, in contact with matter to be mastered, and the only way to use it is to obey it. Obedience to the plough and the plane was indeed the only means of dominating earth and wood. But the formula is not true for our techniques. He who serves these techniques enters another realm of necessity. This new necessity is not natural necessity; natural necessity, in fact, no longer exists. It is technique's necessity, which becomes the more constraining the more nature's necessity fades and disappears. It cannot be escaped or mastered. The tool was not false. But technique causes us to penetrate into the innermost realm of falsehood, showing us all the while the noble face of objectivity of result. In this innermost recess, man is no longer able to recognize himself because of the instruments he employs" (*The Technological Society*, p. 146).

The "intimate quality" of the small-scale technology characteristic of traditional societies concerns in particular the relationships between man and nature understood as a mutual relationship. It is not enough simply to exercise care and restraint in the use of natural resources; we must also cooperate with nature, humbly learning and respecting its own laws and requirements. In modern times the balance of nature has been seriously upset in many areas of the globe by what Professor Nasr calls "the unilateral reaping of the resources of nature for the so-called needs of man" (p. 227). It is no good appealing in a vague and sentimental way to man's obligations and responsibilities to the natural environment. For within a purely secular or humanistic system there is absolutely no reason why man should care anything about the natural

environment beyond what is dictated by self-interest and perhaps also by aesthetic considerations. Only when the so-called ecological crisis is understood as essentially a theological crisis, only when the relationship between man and nature is viewed as having a metaphysical dimension, can the true extent of man's responsibilities to the natural environment be realized. Central to the metaphysical view of man and nature is the belief that the world is not simply an 'environment' in which man as it were accidentally finds himself, but a creation of God in which each sphere of life has its unique place and value and in which man himself has a central and indeed 'priestly' role. And in this context it is appropriate to mention the "extremely timely" fable which Professor Nasr recounts from an Islamic philosophical treatise. It concerns a dispute between man and the animals. The various reasons put forward by man in defense of his exploitation of the animal kingdom, based as they are on purely human advantages, are all rejected by the animals. "Only when animals see that among men there are saints, who in returning to God also fulfill the deepest purpose of the creation of the animal kingdom, do they agree to obey man and to serve him" (p. 63).

"The equilibrium between man and nature in Islamic civilization," writes Professor Nasr, "is exhibited most directly in the human habitat whether it be a small village or a big city. Considering the problem of urbanism and all that urban centers signify in the present-day world as the foci of disorder and the origin of the forces which have caused the ecological crisis, the planning and construction of traditional Islamic cities and towns are of particular significance and worthy of special study" (p. 228). As can be seen in several of the photographs illustrating this book, "villages and towns have been thoroughly integrated into different types of landscape, creating living human units of settlement which are at once beautiful and efficient and which are in complete equilibrium... with their natural surroundings" (p. 228). This equilibrium is preserved even in the case of the larger towns and cities, the major urban units which "have always been the centers of cultural activity for Islamic civilization" (p. 228). "Although cut off from nature to a certain extent through the very fact that it is made by man, the Islamic city has, nevertheless, always succeeded in preserving its equilibrium with the natural environment and the natural forces and elements, such as water, air and light, upon which human life depends. The architecture and city planning of the Islamic city have never been in defiance of nature... Altogether, the architecture of the Islamic city, like that of the small town, brings together nearly all the traditional sciences and technologies and, with the help of them, creates an atmosphere of peace and beauty in equilibrium with the environment and reflecting the innate harmony of the sciences, of which it is one of the major applications" (pp. 228-231). It might indeed be said of any civilization that the planning and condition of its major towns and cities provide the clearest index to the health of that civilization, since it is here, where its cultural, scientific and technological achievements are most concentrated, that its principal weaknesses will also be most in evidence. But although the city is the condition for, and the material symbol of, a certain level of human culture, at the same time by its very artificiality it cuts man off to a considerable degree from the natural sources of his life. What justifies and counter-balances the artificiality of

the city is, surely, the awareness its inhabitants retain of their dependence on the natural world outside the city, and more especially the extent to which they respect and preserve the life of this world.

The resilience as well as the great cultural richness of traditional societies have depended in no small measure then, upon the balance maintained between the urban and the rural elements in their culture. In the particular case of Islam, this balance lay in the creative interplay between the city dweller and the desert nomad. The problem with modern societies, however, is that the urban principle has been developed well beyond the limits within which the freedom and dignity of man is preserved, while the very sophistication of this development serves to mask the real nature of the underlying crisis. The city is not an evil or negative phenomenon in itself, but it has become such through the collective mobilization of man's ignorance and selfishness. If modern science is a betrayal of the traditional conception of science, then the modern process of urbanization and industrialization is a betrayal of the traditional idea of the city, to such an extent that today many of the world's cities constitute megapolitan negations of the traditional city. The huge cities of the modern world cast their destructive shadows into almost every corner of the globe, causing the degeneration not only of their own inhabitants but of all those outside the city who have been forced into some kind of dependence upon it. The complex and ever increasing sophistication of urban living demands an ever more exhaustive exploitation of the earth's natural resources to keep itself going, while the sheer complexity of the modern city in fact works to obscure both the extent of its dependence on the world outside and the reality of the crisis it has brought about. The ultimate illusion of megapolitan man is the belief that the sophistication of his way of life represents a level of security and self-sufficiency greater than has ever been known before in human history.

The modern world, if it continues to follow its present course of development, appears to be faced with a grim alternative. Either modern scientific technology will engineer, through war or pollution, the massive physical destruction of life on this planet, or else it will bring about a society of total efficiency and stability in which even man's instincts and spiritual impulses will be conditioned and rationalized. This society "will not be a universal concentration camp, for it will be guilty of no atrocity. It will not seem insane, for everything will be ordered, and the stains of human passion will be lost amid the chromium gleam. We shall have nothing more to lose, and nothing to win. Our deepest instincts and our most secret passions will be analyzed, published and exploited. We shall be rewarded with everything our hearts ever desired. And the supreme luxury of the society of technical necessity will be to grant the bonus of useless revolt and of an acquiescent smile" (Ellul, p. 427). To the extent that modern civilization could be reformed in accordance with traditional values, then the kind of society mirrored in the pages of Professor Nasr's book clearly provides both a challenge and an inspiration. "When one meditates on classical Islamic civilization, one is struck by the fact that, despite its undeniable dynamism and energy, the element of stability completely dominated it. In studying the Islamic world one does not have a sense of an imminent collapse, of continuous crises in the natural environment,

of disorder and dissolution and the like which now threaten all mankind... There is, in fact, a feeling that, had it not been violently disturbed from the outside, the system interrelating man and his environment in the Islamic world could have continued indefinitely, that the relations between nomadic and sedentary life, between agriculture and technology, between using the resources of nature and catering to nature's needs formed the life-providing rhythm within a living organism whose stability was guaranteed by the order, harmony and complementarity of these elements" (Nasr, p. 227).

And yet classical Islamic civilization came to an end, as must all civilizations whatever their metaphysical basis or lack of one. In this case, a critic might argue, why make the effort to recover a mode of civilization for the survival of which there can be no absolute guarantee? The answer is that a traditional society does not exist for its own self-perpetuation but because, for as long as it survives, it provides man with a quality of life in accordance with his true nature. And the real superiority of the small-scale technology characteristic of traditional societies over the mass technology of the modern world lies in the fact that it expresses the true relationship between nature, man and God. In particular, the makeshift and almost 'nomadic' character of much small-scale technology serves to remind man of the fragile and temporary nature of all human activity and achievements. And yet it would seem that the strong sense of man's creatureliness and of the temporary nature of man's sojourn on earth was not the least of the factors responsible for the relative stability of a civilization like that of classical Islam. Paradoxically, man is most in harmony with the temporal and finite conditions of his life when he is least attached to them as a result of his awareness of the Eternal and infinite.

"The Islamic sciences are so many applications of cosmological principles and therefore, while related on the one hand to the physical world and the natural environment, they are bound on the other hand intimately with the knowledge of a higher order. If they serve the various needs of man's terrestrial life and make possible his living in harmony with his natural environment, they are also means whereby man can journey across the levels of cosmic manifestation to attain ultimate freedom. Their 'utility' is, therefore, twofold: they concern human life here below and also the end of man as a creature destined for immortality. Moreover, their message revolves around the central theme of the utter dependence of the lower states of being upon those above and therefore the necessity to possess the higher knowledge and to live according to the norms of the world of the Spirit in order to be able to cultivate a legitimate knowledge of the world below and to live in harmony and equilibrium with it" (p. 235).

(Original editorial inclusions that followed the essay:)

When God loves a man, sin shall not hurt him.

Muhammad.