

Science and Civilization in Islam

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The Principles of Islam

The history of science is often regarded today as the progressive accumulation of techniques and the refinement of quantitative methods in the study of Nature. Such a point of view considers the present conception of science to be the only valid one; it therefore judges the sciences of other civilizations in the light of modern science and evaluates them primarily with respect to their "development" with the passage of time. Our aim in this work, however, is not to examine the Islamic sciences from the point of view of modern science and of this "evolutionistic" conception of history; it is, on the contrary, to present certain aspects of the Islamic sciences as seen from the Islamic point of view.

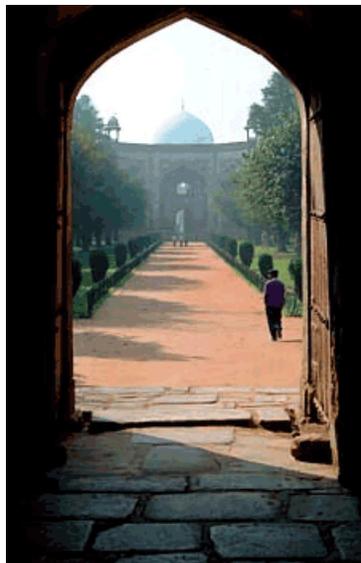
To the Muslim, history is a series of accidents that in no way affect the nontemporal principles of Islam. He is more interested in knowing and "realizing" these principles than in cultivating originality and change as intrinsic virtues. The symbol of Islamic civilization is not a flowing river, but the cube of the Kaaba, the stability of which symbolizes the permanent and immutable character of Islam.

Once the spirit of the Islamic revelation had brought into being, out of the heritage of previous civilizations and through its own genius, the civilization whose manifestations may be called distinctly Islamic, the main interest turned away from change and "adaptation." The arts and sciences came to possess instead a stability and a "crystallization" based on the immutability of the principles from which they had issued forth; it is this stability that is too often mistaken in the West today for stagnation and sterility.

The arts and sciences in Islam are based on the idea of unity, which is the heart of the Muslim revelation. Just as all genuine Islamic art, whether it be the Alhambra or the Paris Mosque, provides the plastic forms through which one can contemplate the Divine Unity manifesting itself in multiplicity, so do all the sciences that can properly be called Islamic reveal the unity of Nature. One might say that the aim of all the Islamic sciences and, more generally speaking, of all the medieval and ancient cosmological sciences is to show the unity and interrelatedness of all that exists, so that, in contemplating the unity of the cosmos, man may be led to the unity of the Divine Principle, of which the unity of Nature is the image.

To understand the Islamic sciences in their essence, therefore, requires an understanding of some of the principles of Islam itself, even though these ideas may be difficult to express in modern terms and strange to readers accustomed to another way of thinking. Yet a statement of these principles is necessary here, insofar as they form the matrix within which the Islamic sciences have meaning, and outside of which any study of them would remain superficial and incomplete.

Islamic civilization as a whole is, like other traditional civilizations, based upon a point of view: the revelation brought by the Prophet Muhammad is the "pure" and simple religion of Adam and Abraham, the restoration of a primordial and fundamental unity. The very word islam means both "submission" and "peace" or "being at one with the Divine Will."



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The creed of Islam "there is no divinity other than God and Muhammad is his prophet" summarizes in its simplicity the basic attitude and spirit of Islam. To grasp the essence of Islam, it is enough to recognize that God is one, and that the Prophet, who is the vehicle of revelation and the symbol of all creation, was sent by him. This simplicity of the Islamic revelation further implies a type of religious structure different in many ways from that of Christianity. There is no priesthood as such in Islam. Each Muslim being a "priest" is himself capable of fulfilling all the religious functions of his family and, if necessary, of his community; and the role of the imam, as understood in either Sunni or Shia Islam, does not in any way diminish the sacerdotal function of each believer. The orthodoxy based on this creed is intangible, and therefore not so closely

bound to specific formulations of dogmatic theology as in Christianity. There have been, to be sure, sectional fanaticism and even persecution, carried on either by rulers or by exoteric theologians, against such figures as al Hallaj and Suhrawardl. Yet the larger orthodoxy, based on the essential doctrine of unity, has always prevailed and has been able to absorb within the structure of Islam all that is not contradictory to the Muslim creed.

In its universal sense, Islam may be said to have three levels of meaning. All beings in the universe, to begin with, are Muslim, i.e., "surrendered to the Divine Will." (A flower cannot help being a flower; a diamond cannot do other than sparkle. God has made them so; it is theirs to obey.) Secondly, all men who accept with

their will the sacred law of the revelation are Muslim in that they surrender their world to that law. When 'Uqbah, the Muslim conqueror of North Africa, took leave of his family and mounted his horse for the great adventure which was to lead him through two thousand miles of conquest to the Moroccan shores of the Atlantic, he cried out: "And now, God, take my soul." We can hardly imagine Alexander the Great having such thoughts as he set out eastward to SPAN >Persia. Yet, as conquerors, the two men were to achieve comparable feats; the "passivity" of 'Uqbah with respect to the Divine Will was to be transmuted into irresistible action in this world.

Finally, we have the level of pure knowledge and understanding. It is that of the contemplative, the gnostic ('arif), the level that has been recognized throughout Islamic history as the highest and most comprehensive. The gnostic is Muslim in that his whole being is surrendered to God; he has no separate individual existence of his own. He is like the birds and the flowers in his yielding to the Creator; like them, like all the other elements of the cosmos, he reflects the Divine Intellect to his own degree. He reflects it actively, however, they passively; his participation is a conscious one. Thus "knowledge" and "science" are defined as basically different from mere curiosity and even from analytical speculation. The gnostic is from this point of view "one with Nature"; he understands it "from the inside," he has become in fact the channel of grace for the universe. His islam and the islam of Nature are now counterparts.

The intellectual function, so defined, may be difficult for Westerners to grasp. Were it not for the fact that most of the great scientists and mathematicians of Islam operated within this matrix, it might seem so far removed as to be irrelevant to this study. Yet, it is closer in fact to the Western tradition than most modern readers are likely to realize. It is certainly very close to the contemplative strain of the Christian Middle Ages a strain once more evoked in part, during the modern era, by the German school of Naturphilosophie and by the Romantics, who strove for "communion" with Nature. Let us not be misled by words, however. The opening of the Romantic's soul to Nature even Keats's "negative capability" of receiving its imprint is far more a matter of sentiment (or, as they loved to call it then, "sensitivity") than of true contemplation, for the truly contemplative attitude is based on "intellection."

We should be mindful here of the changing usage of words. "Intellect" and "intellectual" are so closely identified today with the analytical functions of the mind that they hardly bear any longer any relation to the contemplative. The attitude these words imply toward Nature is the one that Goethe was to deplore as late as the early nineteenth century that attitude that resolves, conquers, and dominates by force of concepts. It is, in short, essentially abstract, while contemplative knowledge is at bottom concrete. We shall thus have to say, by way of re-establishing the old distinction, that the gnostic's relation to Nature is "intellective," which is neither abstract, nor analytical, nor merely sentimental.

Viewed as a text, Nature is a fabric of symbols, which must be read according to their meaning. The Quran is the counterpart of that text in human words; its verses are called ayat ("signs"), just as are the phenomena of Nature. Both Nature and the Quran speak forth the presence and the worlds of God: We shall show them Our portents on the horizon and within themselves until it will be manifest unto them that it is the Truth (41 53).

To the doctors of the Law, this text is merely prescriptive, Nature being present in their minds only as the necessary setting for men's actions. To the gnostic or Sufi, on the other hand, the Quranic text is also symbolic, just as all of Nature is symbolic. If the tradition of the symbolic interpretation of the text of the Sacred Book were to disappear, and the text thereby reduced to its literal meaning, man might still know his duty, but the "cosmic text" would become unintelligible. The phenomena of Nature would lose any connection with the higher orders of reality, as well as among themselves; they would become mere "facts." This is precisely what the intellectual capacity and, indeed, Islamic culture as a whole will not accept. The spirit of Islam emphasizes, by contrast, the unity of Nature, that unity that is the aim of the cosmological sciences, and that is adumbrated and prefigured in the continuous interlacing of arabesques uniting the profusion of plant life with the geometric crystals of the verses of the Quran.

Thus we see that the idea of unity is not only the basic presupposition of the Islamic arts and sciences: it dominates their expression as well. The portrayal of any individual object would become a "graven image," a dangerous idol of the mind, the very canon of art in Islam is abstraction. Unity itself is alone deserving of representation; since it is not to be represented directly, however, it can only be symbolized and at that, only by hints. There is no concrete symbol to stand for unity, however; its true expression is negation, not this, not that. Hence, it remains abstract from the point of view of man, who lives in multiplicity.

Thus we come to the central issue. Can our minds grasp the individual object as it stands by itself? or can we do so only by understanding the individual object within the context of the universe? In other words, from the cosmological point of view, is the universe the unity, and the individual event or object a sign ("phenomenon," "appearance") of ambiguous and uncertain import? Or is it the other way around? Of these alternatives, which go back to the time of Plato, the Muslim is bound to accept the first – he gives priority to the universe as the one concrete reality, which symbolizes on the cosmic level the Divine Principle itself, although that cannot truly be envisaged in terms of anything else. This is, to be sure, an ancient choice, but Islam does inherit many of its theories from pre-existing traditions, the truths of which it seeks to affirm rather than to deny. What it brings to them, as we have already said, is that strong unitary point of view that, along with a passionate dedication to the Divine Will, enabled Islam to rekindle the flame of science that had been extinguished at Athens and in Alexandria.

We have seen that the sacred art of Islam is an abstract art, combin-

ing flexibility of line with emphasis on the archetype, and on the use of regular geometrical figures interlaced with one another. Herein one can already see why mathematics was to make such a strong appeal to the Muslim: its abstract nature furnished the bridge that Muslims were seeking between multiplicity and unity. It provided a fitting texture of symbols for the universe – symbols that were like keys to open the cosmic text.

We should distinguish at once between the two types of mathematics practiced by Muslims: one was the science of algebra, which was always related to geometry and trigonometry; the other was the science of numbers, as understood in the Pythagorean sense. The Pythagorean number has a symbolic as well as a quantitative aspect; it is a projection of Unity, which, however, never leaves its source. Each number has an inherent power of analysis, arising out of its quantitative nature; it has also the power of synthesis because of the inner bond that connects all other numbers to the unit. The Pythagorean number thus has a "personality": it is like a Jacob's ladder, connecting the quantitative with the qualitative domain by virtue of its own inner polarization. To study numbers thus means to contemplate them as symbols and to be led thereby to the intelligible world. So also with the other branches of mathematics. Even where the symbolic aspect is not explicitly stated, the connection with geometric forms has the effect upon the mind of freeing it from dependence upon mere physical appearance, and in that way preparing it for its journey into the intelligible world and, ultimately, to Unity.

Gnosis in the Alexandrian world had used, as the vehicle for the expression of its doctrines, a bewildering maze of mythology. In Islam, the intellective symbolism often becomes mathematical, while the direct experience of the mystic is expressed in such powerful poetry as that of Jalal al-Din Rumi. The instrument of gnosis is always, however, the intellect; reason is its passive aspect and its reflection in the human domain. The link between intellect and reason is never broken, except in the individual ventures of a handful of thinkers, among whom there are few that could properly be called scientists. The intellect remains the principle of reason; and the exercise of reason, if it is healthy and normal should naturally lead to the intellect. That is why Muslim metaphysicians say that rational knowledge leads naturally to the affirmation of the Divine Unity. Although the spiritual realities are not merely rational, neither are they irrational. Reason, considered in its ultimate rather than its immediate aspect, can bring man to the gateway of the intelligible world. Rational knowledge can in the same fashion be integrated into gnosis, even though it is discursive and partial while gnosis is total and intuitive. It is because of this essential relationship of subordination and hierarchy between reason and intellect, rational knowledge and gnosis, that the quest for causal explanation in Islam only rarely sought to, and never actually managed to, satisfy itself outside the faith, as was to happen in Christianity at the end of the Middle Ages.

This hierarchy is also based on the belief that scientia – human knowledge – is to be regarded as legitimate and noble only so long as it is subordinated to sapientia – Divine wisdom. Muslim sages would agree with Saint Bonaventure's "Believe, in order to understand." Like him, they insist that scientia can truly exist only in con-

junction with sapientia, and that reason is a noble faculty only insofar as it leads to intellection, rather than when it seeks to establish its independence of its own principle, or tries to encompass the Infinite within some finite system. There are in Islamic history one or two instances when rationalist groups did attempt to establish their independence of and opposition to the gnostics, and also to set themselves against other orthodox interpreters of the Islamic revelation. The spiritual forces of Islam were always strong enough, however, to preserve the hierarchy between intellect and reason, and thus to prevent the establishment of a rationalism independent of the revelation. The famous treatises of al-Ghazzali, in the fifth/eleventh century, against the rationalistic philosophers of his time mark the final triumph of intellection over-independent ratiocination a triumph that did not utterly destroy rationalistic philosophy, but did make it subordinate to gnosis. As a result of this defeat by al-Ghazzali and similar figures of the syllogistic and systematic Aristotelian philosophy in the fifth/eleventh century, the Islamic gnostic tradition has been able to survive and to remain vital down to the present day, instead of being stifled, as elsewhere, in an overly rationalistic atmosphere.

The reaction against the rationalists, of which the writings of al-Ghazzali mark the high point, coincides roughly in time with the spread of Aristotelianism in the West, which led ultimately to a series of actions and reactions the Renaissance, the Reformation, and the Counter-Reformation such as never occurred in the Islamic world. In the West, these movements led to new types of philosophy and science such as characterize the Western world today, that are as profoundly different from their medieval antecedents as is the mental and spiritual horizon of modern man from that of traditional man. Europe in that period began to develop a science of Nature that concerns itself only with the quantitative and material aspects of things, meanwhile, the tide of Islamic thought was flowing back, as before, into its traditional bed, to that conceptual coherence that comprises the mathematical sciences.

Today, as in the past, the traditional Muslim looks upon all of science as "sacred," and studies this sacred science in a well-established threefold articulation. First, within the reach of all, is the Law, contained in essence in the Quran, elucidated by tradition and jurisprudence, and taught by the doctors; it covers every aspect of the social and religious life of the believer. Beyond that lies the Path dealing with the inner aspect of things, which governs the spiritual life of those who have been "elected" to follow it. This has given rise to the various Sufi brotherhoods, since it is actually a way of life built upon communication at a personal, nonsystematic level. Finally, there is the ineffable Truth itself, which lies at the heart of both these approaches.

According to a still-current simile, the Law is as the circumference of a circle, of which the Path is the radius, and the Truth the center. The Path and the Truth together form the esoteric aspect of Islam, to which Sufism is dedicated. At its core lies a metaphysical intuition, knowledge such as comes only to the right "mode in the knower." From this springs a science of the universe, a science of the soul, and the science of mathematics, each of them in essence a different metaphorical setting for that one science that the mind strives after, each of them a part of that gnosis that comprehends all

things.

This may help explain why the mathematician, who was something of a displaced person in the West right up to the late Middle Ages, plays a central role in Islam from the very start. Two centuries after the establishment in the Near East of Christianity (in A.D. 313), the Christian-dominated West was still sunk deep in barbarism. Yet two centuries after Muhammad, the Islamic world under the Caliph Harun al Rashid was already far more active culturally than the contemporaneous world of Charlemagne even with the latter's earlier start. What reached the West from Islam at that time was little more than dark tales of incredible wealth and wondrous magic. In Islam itself, however, the mathematician's craft, having "found its home," was already able to satisfy the civilized man's desire for logical subtlety and for intellectual games, while philosophy itself reached out into the mysteries beyond reason.

This early stabilization of the theoretical outlook of Islam extended also to the type of man who embodied it. Whereas the role of intellectual leadership in the West devolved upon several different figures in turn the Benedictine monk, the scholastic doctor, the lay scientist the central figure in Islam has remained almost unchanging. He is the hakim, who encompasses within himself some or all of the several aspects of the sage; scholar, medical healer, spiritual guide. If he happens to be a wise merchant too, that also falls into the picture, for he is traditionally an itinerant person. If his achievements in mathematics are extraordinary, he may become a figure like Umar Khayyam. It is clear, moreover, that such a man be his name even Avicenna will never be able to develop each of his several attainments in the same fashion as the single-faceted specialist may. Such specialists do exist in Islam, but they remain mostly secondary figures. The sage does not let himself be drawn into the specialist's single-level "mode of knowing," for then he would forfeit the higher knowledge. Intellectual achievement is thus, in a sense, always patterned upon the model of the unattainable complete, that "total thing" that is not found in the Greek tradition. Ptolemy's *Synaxis* becomes in the Muslim world the *Almagest* or *Opus Maximum* even as Aristotle is purely and simply *al-failasuf* (the philosopher).

The title of Avicenna's great treatise, *Kitab al-Shifa*, which rivals in scope the Aristotelian corpus, means *The Book of Healing*. As the title implies the work contains the knowledge needed to cure the soul of the disease of ignorance. It is all that is needed for man to understand; it is also as much as any man need know. Newton's work *Principia* has an obviously far different ring: it means a foundation essentially, a "beginning" rather than a knowledge that is complete and sufficient for man's intellectual needs as the titles of so many medieval Islamic texts imply.

< Islamic within Perspectives The >Islam came into the world at the beginning of the seventh century A.D., its initial date (the journey of the Prophet from Mecca to Medina) being 622 A.D.; it had spread over all of the Middle East, North Africa, and Spain, by the end of that same century. Just as the Islamic religion is one of the "middle way," so too did its territory come to occupy in fact, it still occupies the "middle belt" of the globe, from the Atlantic to the Pacific. In this region, the home of many earlier civilizations, Islam

came into contact with a number of sciences which it absorbed, to the extent that these sciences were compatible with its own spirit and were able to provide nourishment for its own characteristic cultural life.

The primordial character of its revelation, and its confidence that it was expressing the Truth at the heart of all revelations, permitted Islam to absorb ideas from many sources, historically alien yet inwardly related to it. This was especially true in regard to the sciences of Nature, because most of the ancient cosmological sciences – Greek, as well as Chaldean, Persian, Indian, and Chinese – had sought to express the unity of Nature and were therefore in conformity with the spirit of Islam. Coming into contact with them, the Muslims adopted some elements from each most extensively, perhaps, from the Greeks, but also from the Chaldeans, Indians, Persians, and perhaps, in the case of alchemy, even from the Chinese. They united these sciences into a new corpus, which was to grow over the centuries and become part of the Islamic civilization, integrated into the basic structure derived from the Revelation itself.

The lands destined to become parts of the medieval Islamic world – from Transoxiana to Andalusia – were consolidated into a new spiritual universe within a single century after the death of the Prophet. The revelation contained in the Quran, and expressed in the sacred language (Arabic), provided the unifying pattern into which many foreign elements became integrated and absorbed, in accordance with the universal spirit of Islam. In the sciences, especially those dealing with Nature, the most important source was the heritage of Greek civilization.

Alexandria, by the first century B.C., had become the center of Greek science and philosophy, as well as the meeting place of Hellenism with Oriental and ancient Egyptian influences, out of which came Hermeticism and Neoplatonism. The Greek heritage, itself to a great extent an assemblage of ancient Mediterranean views, systematized and put into dialectical form by the peculiar discursive power of the Greeks passed from Alexandria to Antioch, and from there to Nisibis and Edessa, by way of the Christian Monophysites and Nestorians. The latter were particularly instrumental in the spreading of Greek learning, chiefly in Syriac translation, to lands as far east as Persia.

In the third century A.D., Shapur I founded Jundishapur at the site of an ancient city near the present Persian city of Ahwaz, as a prisoner-of-war camp, for soldiers captured in the war with Valerian. This camp gradually grew into a metropolis, which became a center of ancient sciences, studied in Greek and Sanskrit and later in Syriac. A school was set up, on the model of those at Alexandria and Antioch, in which medicine, mathematics, astronomy, and logic were taught, mostly from Greek texts translated into Syriac, but also elements of the Indian and Persian sciences were included. This school, which lasted long after the establishment of the Abbasid caliphate, became an important source of ancient learning in the Islamic world.

Aside from those more obvious avenues, there were also lines of communication with more esoteric aspects of the Greek sciences, particularly the Pythagorean school, through the community of

Sabaeans of Harran. This religious community traced its origin to the Prophet Idns (the Enoch of the Old Testament), who is also regarded in the Islamic world as the founder of the sciences of the heavens and of philosophy, and who is identified by some with Hermes Trismegistus. The Sabaeans possessed a remarkable knowledge of astronomy, astrology, and mathematics; their doctrines were in many respects similar to those of the Pythagoreans. It was probably they who provided the link between the Hermetic Tradition and certain aspects of the Islamic esoteric doctrines, into which some elements of Hermeticism were integrated.

On the Oriental side the Indian and, to a lesser degree, the Persian sciences came to have an important bearing upon the growth of the sciences in Islam, a bearing far greater than is usually recognized. In zoology, anthropology, and certain aspects of alchemy, as well as, of course, in mathematics and astronomy, the tradition of Indian and Persian sciences was dominant, as can be seen in the Epistles (Rasail) of the Brethren of Purity (Ikhwan al-Safâ') and the translations of Ibn Muqaffâ'. It must be remembered that the words "magic" and Magi are related, and that, according to the legend, the Jews learned alchemy and the science of numbers from the Magi, while in captivity in Babylon.

There are most likely elements of Chinese science in Islam, especially in alchemy, pointing to some early contact between the Muslims and Chinese science. Some have even gone so far as to claim without much proof, to be sure – that the word al-klmiya' from which "alchemy" is derived, is itself an arabization of the classical Chinese word Chin-l which in some dialects is Kim-Ia and means "the gold-making juice." The most important influence from China, however, was to come in later centuries, particularly after the Mongol invasion, and then primarily in the arts and technology.

The totality of the arts and sciences in Islam thus consisted of a synthesis of the ancient sciences of the Mediterranean people, as incorporated and developed by the Greeks, along with certain Oriental elements. The dominant part of this heritage was definitely Graeco-Hellenistic, in translations either from Syriac or from the Greek itself, by such masters of translation as Hunain ibn Ishaq, and Thabit ibn Qurrah. There were numerous translations of Greek authors into Arabic in nearly every domain of knowledge. The ideas and points of views contained in these translations formed a large part of the nutriment which Islam sampled and then assimilated according to its own inner constitution, and the foundation given to it by the Quranic revelation. In this way there developed, in conjunction with the three basic "dimensions" of the Law, the Path, and the Truth, Islamic schools which were to become an accepted part of Islamic civilization.

With respect to Greek learning itself, Muslims came to distinguish between two different schools, each possessing a distinct type of science: one, the Hermetic-Pythagorean school, was metaphysical in its approach, its sciences of Nature depending upon the symbolic interpretation of phenomena and of mathematics; in the other, the syllogistic-rationalistic school of the followers of Aristotle, the point of view was philosophical rather than metaphysical, and its sciences were therefore aimed at finding the place of things in a rational system, rather than at seeing, through their appearances,

their heavenly essences. The first school was regarded as the continuation, in Greek civilization, of the wisdom of the ancient prophets, especially Solomon and Idris; it was therefore considered to be based on divine rather than human knowledge. The second school was looked upon, for the most part, as reflecting the best effort the human mind could make to arrive at the truth, an effort of necessity limited by the finite nature of human reason. The first school was to become an integral part of Islam, certain of its cosmological sciences being integrated into some of the branches of Sufism. The second school did have many disciples in the earlier centuries and thus left an influence upon the language of Muslim theology after the seventh/thirteenth century, it lost ground, however and, despite its continuation up to the present day, it has remained a secondary aspect of Islamic intellectual life.

The various levels of reference existing hierarchically within the structure of Islam are presented concisely by a sage who lived in the fifth/eleventh century, and who is probably the one Oriental figure most familiar to the modern Western public: 'Umar Khayyam, mathematician and poet extraordinary. That he should be regarded in the Western world, on the strength of his famous quatrains as a skeptical hedonist is itself a sign of the profound lack of understanding between the two worlds; for he was in reality a sage and a gnostic of high standing. What appears to be lack of concern or agnosticism in his poetry is merely an accepted form of expression, within which he incorporated both the drastic remedy that the gnostic applies to religious hypocrisy, and also the reestablishment of contact with reality. (Late Greeks, such as Aenesidemus, had had recourse to the same skeptical device, and with similar intentions.) In the following passage from a metaphysical treatise, Khayyam divides the seekers after knowledge into four categories:

(1) The theologians, who become content with disputation and "satisfying" proofs, and consider this much knowledge of the Creator (excellent is His Name) as sufficient.

(2) The philosophers and learned men [of Greek inspiration] who use rational arguments and seek to know the laws of logic, and are never content merely with "satisfying" arguments. But they too cannot remain faithful to the conditions of logic, and become helpless with it.

(3) The Ismailis [a branch of Shia Islam] and others who say that the way of knowledge is none other than receiving information from a learned and credible informant; for, in reasoning about the knowledge of the Creator, His Essence and Attributes, there is much difficulty; the reasoning power of the opponents and the intelligent [of those who struggle against the final authority of the revelation, and of those who fully accept it] is stupefied and helpless before it. Therefore, they say, it is better to seek knowledge from the words of a sincere person.

(4) The Sufis, who do not seek knowledge by meditation or discursive thinking, but by purgation of their inner being and the purifying of their dispositions. They cleanse the rational soul of the impurities of nature and bodily form, until it becomes pure substance. It then comes face to face with the spiritual world, so that the forms of that world become truly reflected in it, without doubt or ambiguity.

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This is the best of all ways, because none of the perfections of God are kept away from it, and there are no obstacles or veils put before it. Therefore, whatever [ignorance] comes to man is due to the impurity of his nature; if the veil be lifted and the screen and obstacle removed, the truth of things as they are will become manifest. And the Master [the Prophet Muhammad] – upon whom be peace – indicated this when he said: "Truly, during the days of your existence, inspirations come from God. Do you not want to follow them?" Tell unto reasoners that, for the lovers of God [gnostics] intuition is guide, not discursive thought.

Here we have, stated authoritatively, the central perspective of Islamic thought, in which the component parts fall naturally into place. Each one is a different mode of knowing. It is puzzling at first sight to find nowhere in it the mathematicians, of whom Khayyam himself was such an eminent example. Notice, however, that the Ismailis correspond quite closely with what in the early Pythagorean school had been the Akusmatikoi, "those who go by what is told them." It should be noticed, also, that the Pythagorean Mathematikoi, the "expounders of the doctrine," will be found both among the philosophers and again among the Sufis, since systematic theory remains helpless without spiritual achievement, which is precisely what mathematics is intended to lead to, by contrast with syllogistic hair-splitting. This is clearly revealed in later sections of the same work in which Khayyam describes himself as both an orthodox Pythagorean and a Sufi.

Here, too, we see the significant contrast with the Greek world. For the Pythagorean doctrines alluded to had become practically extinct there by the time of Aristotle, and were to be taken up again, and at that only after a fashion, in the Hellenistic revival; in Islam, we see them stabilized and restored almost according to their original pattern through the unitary religious idea. Islam was thus able to hand on to the West, to the extent that the latter accepted the Pythagorean tradition, something more coherent, as well as technically more advanced, than the West's own immediate heritage from antiquity.

There are other lines to be found in Khayyam's spectrum. The "atomistic" school of thought which flourished in Islam after the fourth/tenth century, and which in the Western perspective might be supposed to be scientific, he regards as not belonging to science at all, but to theology, for the Ash'arites who represented this school were exactly the sort of "theologians" he described. In the writings of the followers of this school, especially al-Baqillam, who may be considered their outstanding "philosopher of Nature," "the continuity of external forms is broken by an "atomistic" doctrine of time and space, and by the denial of the Aristotelian notion of causality. For the Ash'arites (as also for the Sufis), the world is annihilated and recreated at every moment; the cause of all events is the Creator and not a finite, created agent. A stone falls because God makes it fall, not because of the nature of the stone or because it is impelled by an external force. What appears as "Laws of Nature," i.e., the uniformity of sequence of cause and effect, is only a matter of habit, determined by the will of God and given the status of "law" by Him. Miracles, which seem to break the apparent uniformity of natural phenomena, are simply going against the "habit" of

Nature; the Arabic word for a supernatural event means literally that which results from "rupture of habit." We are facing here a strict "consequentiality," which has its parallel in Western thought of the seventeenth century. From Descartes to the Occasionalists, the development presents curious similarities.

In the second grouping on Khayyam's list, the "philosophers and learned men," we would find assembled all the famous names of Islamic science. There is a sharp distinction, however, between two schools of "philosophical" thought, both of which profess to be disciples of the Greeks. The first is the Peripatetic school, whose doctrines are a combination of the ideas of Aristotle and of some Neoplatonists. The representative of this school who was closest to Aristotle was Averroes who, paradoxically, had less effect upon the Islamic than upon the Christian world, and should be studied more as a great member of the tradition of Western philosophy than as an integral part of Islamic intellectual life.

The science of Nature cultivated by the Peripatetic school is primarily syllogistic: it seeks to determine the place of each being, in a vast system based upon the philosophy of Aristotle. The best expression of the doctrines of this school appears in Avicenna's early writings. The Book of Healing is the most comprehensive encyclopedia of knowledge ever written by one person, and undoubtedly the most influential Peripatetic work in Islam. The other Islamic school professing to follow the Greeks was much more sympathetic to the Pythagorean-Platonic than to the Aristotelian tradition. This school, which in later centuries came to be called the Illuminist (ishraqi) school, asserts that it derives its doctrines not only from the Pythagoreans and their followers, but from the ancient Prophets, the Hermetic Tradition, and even from the ancient Zoroastrian sages. The symbolic works of Avicenna, such as Living Son of the Awake (Hayy ibn Yaqzan) are early expressions of the writings of this school. The greatest Illuminist philosopher, however, is Suhrawardi, who drew his symbolism from all the many sources mentioned above. The sciences of Nature, as well as the mathematics cultivated by certain adherents of this school, are primarily symbolic, and resemble to a great extent the writings of some Neoplatonists. Nature becomes for the writers of this school a cosmic crypt from whose confines they must seek to escape and on their journey through it, they see in its phenomena "signs," which guide them on the road toward final "illumination." Many Illuminists, particularly those of later centuries, have also been Sufis, who have made use of the eminently initiatic language of the Illuminist philosophers to describe the journey of the Sufi toward gnosis. Many members of this school, and in general the learned men whom Khayyam mentions, have also been among the group that have cultivated mathematics, astronomy, and medicine; for these learned men took an interest in all the arts and sciences, and helped to keep alive the traditions of learning in those fields, as an integral part of their studies in philosophy.

The Peripatetics were very strong during the fourth/tenth and fifth/eleventh centuries, but their influence weakened during the succeeding period. The Illuminists, on the other hand, became strong after the sixth/twelfth century and al-Ghazzah's triumph. They have had a continuous tradition down to the present day,

chiefly because of the metaphysical (as against rationalistic) emphasis in their doctrines, and also because of the use of their language by certain Sufi masters. One of the greatest exponents of Illuminist doctrines, as interpreted and modified by the Safavid sage Mulla Sadra, was Hajil Mulla Hadi Sabziwari who died in Persia less than a century ago.

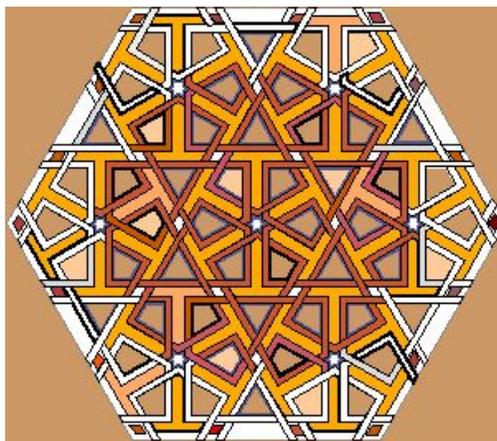
The Ismailis, to whom Khayyam next refers, are a branch of Shia Islam, which was very powerful in his time, and also played a considerable role in the cultivation of the arts and sciences. Ismaili doctrines are fundamentally esoteric, being based on numerical symbolism and the symbolic interpretation of the "cosmic text." The symbolic interpretation of the Quran, which is basic in Shia Islam as well as in Sufism, was made the basis for the symbolic study of Nature. Moreover, such sciences as alchemy and astrology became integrated into their doctrines, and such texts as the Epistles of the Brethren of Purity, and the numerous writings of Jabir ibn Hayyan, the alchemist, were to have their greatest influence upon this group. The development of what has been called "Oriental neo-Pythagoreanism" is found most clearly in the treatises of the Ismailis. They were very much interested in the sciences of Nature; in integrating the rhythms and cycles of Nature with the cycles of history and with the manifestations of various prophets and imams, their works rank among the most important Islamic writings on Nature.

Khayyam mentions, finally, the Sufis or gnostics, the group to which he himself belonged. It may seem surprising that a man so well versed in the arts and sciences of his day should consider the "way of purification" of the Sufis as the best way of acquiring knowledge. His language in this regard, however, is not merely theoretical, it is almost operational: one cleanses and focuses the instrument of perception, i.e., the soul, so that it may see the realities of the spiritual world. Aristotle himself, the great rationalist, had once said that "knowledge is according to the mode of the knower." The gnostic, in employing the "right" mode of knowledge ensures that Intellection takes place in him immediately and intuitively. In this regard, Khayyam's statement becomes clearer when seen in the light of a doctrine that we shall discuss later: the doctrine of the universal man, who is not only the final goal of the spiritual life, but also the archetype of the universe.

To the extent that the gnostic is able to purify himself of his individualistic and particular nature, and thus to identify himself with the universal man within him, to that same extent does he also gain knowledge of the principles of the cosmos, as well as of the Divine realities. For the gnostic, knowledge of Nature is secondary to knowledge of the Divine Principle; yet, because of the rapport between the gnostic and the universe, Nature does play a positive role in guiding him to his ultimate goal. The phenomena of Nature become "transparent" for the gnostic, so that in each event he "sees"

the archetype. The symbols of substances – geometric forms and numerical quantities, colors, and directions – these and many other such symbols are aspects of the being of things. They increase in their reality – a reality independent of personal taste or of the individual – to the extent that the gnostic divorces himself from his individual perspective and limited existence, and identifies himself with Being. For the gnostic, the knowledge of anything in the universe means ultimately knowledge of the relationship between the essence of that particular being and the Divine Intellect, and the knowledge of the ontological relationship between that being and Being itself.

Khayyam's classification did not take into consideration certain writers of great importance, who did not follow any particular school. There are also many Islamic writers, hakims, including Khayyam himself, who possessed a knowledge of several disciplines, and in whom two or more levels of his hierarchy of knowledge may be found. Some of the most outstanding of these men will be discussed in the next chapter.



...its ultimate aim has always been to relate the corporeal world to its basic spiritual principle, through the knowledge of those symbols which unite the various orders of reality.

As much as the hierarchy of knowledge in Islam, as it has existed historically, has been united by a metaphysical bond much as a vertical axis unites horizontal planes of reference the integration of these diverse views "from above" has been possible. Historically, of course, there have been many conflicts, sometimes disputes leading to violence and occasionally to the death of a writer. Such conflicts are not, however, as elsewhere, between incompatible orthodoxies. They are regarded by most Islamic commentators as due to the lack of a more universal point of view on the part of those who have only embraced a less universal one. Only the gnostic, who sees all things "as they really are," is able to integrate all these views into their principal unity.

Regarded from their own point of view, each of these schools may be said to possess a certain "philosophy of Nature, and, in conformity with it, to cultivate the sciences dealing with the universe. Some of their writings, primarily those of the Peripatetics, were to be translated into Latin to help form that Western scholasticism which was later to give way to seventeenth-century "natural philosophy." Other writings, such as those of the alchemists, were to flourish in the Western world for several centuries, only to wither away in its atmosphere of rationalistic philosophy. There were still other works, especially those of the Sufis and Illuminists, which were to have an influence on certain Western circles such as that of Dante, and yet for the most part to remain almost unknown in the Western world, down to comparatively recent times.

In this brief introduction, it has been necessary to cover much ground that is unfamiliar and often quite difficult for a Western reader to grasp. But we felt that we had to dispel the common conception of the Muslims as merely Puritan warriors and merchants,

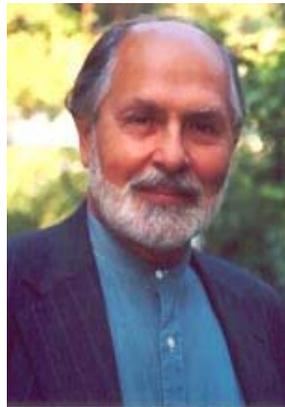
whose strange bent for the "subtleties" of algebra and logic somehow also enabled them to become the transmitters of Greek learning to the West. As against that all too current notion, we have tried to present a brief picture of a culture whose spiritual values are inextricably tied up with mathematics and with metaphysics of a high order, and which once again fused the constituent elements of Greek science into a powerful unitary conception, which had an essential influence on the Western world up to the time of the Renaissance.

Strangely enough, it is this latter conception, half unknown at best, and then quickly forgotten in the West, which has remained, up to the present Western impact upon the Islamic world, the major factor in the Islamic perspective determining its attitude toward Nature and the meaning it gives to the sciences of Nature; conversely, it is those very elements of the Islamic sciences, most responsible for providing the tools with which the West began the study of the already secularized Nature of the seventeenth century, that became secondary in the Islamic world itself and had already ceased to occupy the main intellectual efforts of that civilization by the ninth/fifteenth century.

The Western world has since concentrated its intellectual energies upon the study of the quantitative aspects of things, thus developing a science of Nature, whose all too obvious fruits in the physical domain have won for it the greatest esteem among people everywhere, for most of whom "science" is identified with technology and its applications. Islamic science, by contrast, seeks ultimately to attain such knowledge as will contribute toward the spiritual perfection and deliverance of anyone capable of studying it; thus its fruits are inward and hidden, its values more difficult to discern. To understand it requires placing oneself within its perspective and accepting as legitimate a science of Nature which has a different end, and uses different means, from those of modern science. If it is unjust to identify Western science solely with its material results, it is even more unjust to judge medieval science by its outward "usefulness" alone. However important its uses may have been in calendrical work, in irrigation, in architecture, its ultimate aim has always been to relate the corporeal world to its basic spiritual principle, through the knowledge of those symbols which unite the various orders of reality. It can only be understood, and should only be judged, in terms of its own aims and its own perspectives.

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