



The Qur'ān and the Scientific Spirit: An Exploration of Key Issues

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Abstract

The aim of this paper is to demonstrate the role of the Qur'ān in inspiring scientific spirit. It starts with the analysis of the unifying concept of *al-Tawhīd* as the main message of the Qur'ān. *Al-tawhīd* becomes the motivating factor behind the pursuit of knowledge to show Divine Unity within the realm of creation. Muslim philosopher and scientists of the classical period (8th to 13th century) in Islamic civilisation worked hard to demonstrate this unity by exploring the world of nature. They employed what has been regarded as 'modern' scientific methods as we understand now with such precision and accuracy. This paper discusses the intricate link between their understanding of *Tawhīd* and the pursuit of natural sciences. Within the framework of *Tawhīd* that enlightens humankind on life and the universe, these Muslim philosopher and scientists were able to discover, invent and even theorise about the universe. The paper then selects some of the basic scientific conceptual tools of definition, observation and experimentation and logical interpretations that are used in the study of nature and trace their Qur'ānic foundation of such methods.

Keywords: *Tawhid, science, methodology, tools, unity.*

Abstrak

Tujuan kajian ini adalah untuk menunjukkan peranan Qur'ān dalam memberi inspirasi semangat saintifik. Ia bermula dengan analisis konsep penyatuan *al-Tawhīd* sebagai mesej utama daripada Qur'ān. *al-Tawhīd* menjadi faktor motivasi pembelajaran ilmu untuk menunjukkan Perpaduan Ilahi dalam alam ciptaan. Ahli falsafah dan ahli sains zaman klasik (8 hingga abad ke-13) dalam tamadun Islam Islam bekerja keras untuk menunjukkan perpaduan ini dengan meneroka dunia alam semula jadi. Pekerjaan mereka dianggap sebagai kaedah saintifik 'moden' seperti yang kita fahami sekarang dengan ketepatan dan ketelitian. Kajian ini membincangkan pautan rumit di antara pemahaman tentang *Tawhīd* dan pencarian sains semula jadi. Dalam rangka *Tawhīd* yang menerangi manusia tentang kehidupan dan alam semesta, ini ahli falsafah dan saintis Islam boleh menemui, mencipta dan juga membina Teori mengenai alam semesta. Kajian ini memilih beberapa alat konsep saintifik asas definisi, pemerhatian dan uji kaji serta tafsiran logik yang diguna pakai dalam kajian alam dan mengesan kaedah asas Qur'ān tersebut.

Kata kunci: *Tawhīd, ilmu, kaedah, alat, perpaduan.*

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Introduction

This paper intends to demonstrate the role of the Qur'an in inspiring scientific spirit. The widespread 'belief' that religion and science are incompatible has created a dualistic education that has given rise to two groups of intellectuals. Discussing the capability of sacred texts in inspiring scientific spirit seems useless to those whose minds have accepted the thesis of the incompatibility of religion and science. Islamic intellectual tradition however demonstrated that there always exist a close link between religion and science and especially so with the Qur'an as a main source of inspiration to scientific activities. This relation is manifold and can be illustrated from the broad scientific disciplines that developed across the span of approximately eight hundred years of Islamic civilisation. Examples illustrating the centrality of Qur'an in the development of scientific attitude and frame of mind within the various disciplines of science like natural and mathematical sciences are one of the many examples that can be mentioned in this article. This article focuses on the questions of the components of the scientific minds of the early Muslim scientists. Secondly, the article explores ways how classical¹ Muslim scientists harmonised metaphysical principles and physical realities. In answering these questions, this article will seek to show how the Qur'an inspires a scientific attitude and frame of mind by delineating the fundamental message of the Qur'an – *al-Tawhīd*, and its relation to the scientific spirit – citing from the Qur'anic verses that demonstrate the use of fundamental scientific conceptual tools of definition, observation and experimentation and logical interpretation will be discussed in this paper.

Al-Tawhīd:² The Fundamental Inspiration towards Knowledge

The Qur'an is a Book whose Truth can be affirmed through the signs present in the cosmos as well as within us.³ Qur'an's variant names⁴ denote the comprehensive nature of the fully preserved message⁵ within. For believing Muslims, regardless of their geographical location or period of existence, it is the heartbeat of their faith, a remembrance in times of joy and anguish, a treasury of wisdom and a fountain of precise scientific realities. The central message in the Qur'an revealed to Prophet Muhammad is to establish the Unity of God in the human consciousness. The essence of this Unity is summarised aptly in the first part of the *shahādah* that there is no God but Allāh (*lā ilāha illā Allāh*). This testimony is a statement of knowledge concerning the Reality (O. Bakar, 2008), is what is generally known

as the principle of *al-Tawhīd* where it is "...the act of affirming Allāh to be One, the Absolute, Transcendent Creator, the Lord and Master of all that is." (Al-Fārūqī, 1992). In order to achieve this, a person is required to affirm that God is One in His Essence, His Attributes and Qualities. This affirmation is translated into the acceptance of the cosmic⁶ unity⁷ where all things are interrelated as the realised Will of God and governed by the unaltered patterns of natural law implanted into creation where these natural laws cannot be violated by nature⁸ and it is a total fulfilment of what nature is capable of doing.⁹

It is clear that the first part of *shahādah* is a statement of knowledge. A person who utters the *shahādah* must ensure that what he uttered is an accepted truth in his mind and in his heart. It must be uttered with the acknowledgement of the mind through the various fields of knowledge with overflowing evidence that points to the truth of the *shahādah*. As one of the names of God is *al-Haqq*¹⁰ (The Truth), the quest for the true nature of things leads him towards witnessing the various grades of truth manifested from The Truth at various levels. Through the demonstration of the interrelatedness of all parts of the known universe, the quest in affirming the Qur'anic argument that the cosmic unity is a proof of Divine Unity¹¹ reaches certitude. The *shahādah*, principally *al-Tawhīd* now becomes a synthesising tool (O. Bakar, 2011) that brings the cosmic unity, particularly, the unity of knowledge of the various realities observed in the natural world.

The acceptance of this fundamental statement of the *shahādah*, creates curiosity in the inquiring minds of Muslims to uncover the mysteries of the revelations from the descriptions of the phenomenon or from its linguistic perspective. This guided the curious intellectual minds to travel towards the Transcendent by the disclosure of inner truths of the open book of nature.¹² The continuous link in the development of this mental model and worldview from the time of the Prophet created a strong foundation for the later Muslims when they embarked into the fields of science. Here Osman Bakar¹³ explains how *al-Tawhīd* inspired the earlier generations of Muslims into the quest of knowledge:

...they relate science to *al-tawhīd* through giving meaningful expressions in both theory and practice to two of the latter's most fundamental corollaries, namely the principle of cosmic unity, particularly the unity of the natural world and the principle of the unity of knowledge and of the sciences. Muslim philosophers-scientists make the two corollaries as both the foundation and the goal of science. As they

succeed in expanding the horizons of science through the creation of new knowledge, they become not less but more certain of the truth of the above goal of science. Through the demonstration of the interrelatedness of all parts of the known universe, they become more convinced that they have succeeded in affirming the Qur'an's argument that the cosmic unity is a clear proof of Divine Unity. (O. Bakar, 2008).

Science and the Scientific Spirit

According to the online Oxford English Dictionary, the word science is the present participle of the root word *scire* in Latin which means "to know". Its Latin counterpart is *scientia* which means knowledge. Lexicographically, science means "the collective body of knowledge in a particular field or sphere" where in the 12th century it includes "knowledge granted by God"¹⁴. Clarence Karier defined science as any organised knowledge which can also include theology (Karier, 1986). Another definition from the Oxford online dictionary states that science is "knowledge derived from experience, study, or reflection" whereas the Cambridge online dictionary states that science is "knowledge from the careful study of the structure and behaviour of the physical world, especially by watching, measuring, and doing experiments, and the development of theories to describe the results of these activities"¹⁵. In the *Webster's New World Dictionary*, we observed the transformation of the definition of science from "a state or fact of knowing and very often is taken in the sense of knowledge contrasted from intuition or belief" to "a systematic knowledge based on sense perception" and then as "a systematic knowledge of the physical world".¹⁶ Science in modern understanding has restricted itself to only the physical world, with sense perception, with or without using tools as its only legitimate way of knowing. However in the Islamic intellectual tradition, the word *'ilm* which is commonly defined as "knowledge of something as it is"¹⁷ is considered to be similar to science and at times it denotes knowledge. According to Mulyadhi Kartanegara¹⁸, science has restricted itself to the physical domain whereas the concept of *'ilm* transcends the physical fields to include the non-physical domains as well but both of these concepts are not just any opinion (*al-ra'y*) or fact but a well proven and established knowledge that has gone through thorough process of scrutiny (Kartanegara, 2003). Therefore, science as understood by Muslims deals with various domains of nature where it has its roots and principles in metaphysics and never leaves the world of sacred. In contrast, the modern conceptual of science has its premises completely

immersed in empiricism and rationalism without any connection with knowledge of the higher order (Nasr, 1993).

What is the scientific spirit? From the discussion on the definitions of science, one can imply that the modern understanding of the scientific spirit is the spirit of inquiry or curiosity about the physical world that acts as the first step in developing new knowledge. The development of knowledge from the scientific spirit must follow the scientific method¹⁹ that deals with the question of how we can know the object of knowledge²⁰. The Scientific method relies heavily on experimentation (*tajribī*) and observation as the means to establish new knowledge. In contrast, the scientific method understood and utilised in Islamic intellectual tradition grew from the comprehensive understanding of *'ilm* that transcends the physical domains. As *'ilm* is knowledge of something as it is, the methods in knowing these objects of knowledge must be directly dependent on the nature of the object of knowledge. Muslim philosopher-scientists, on top of using the experimental method employed logical method (*burhānī*) and intuitive method (*'irfānī*) or a combination of these methods in conducting research on different objects of sciences (Kartanegara, 2003). For example, *Ibn Haytham* in delineating his theory of vision and optics employed both the physical and mathematical methodologies because both inquiries play an equally important role in demonstrative and scientific method and due to the inherent weakness of sense perception, supporting tools are required for direct vision (O. Bakar, 1996). In his *magnum opus*, *Kitāb al-Manāẓir* (The book of Optics), *Ibn Haytham* mentioned that the inherent weaknesses are due to factors like distance, position, transparency, opacity, duration of sight and the condition of the eye.²¹ For him, the physical inquiry or the experimental method is employed to obtain the knowledge on the nature of light or of transparency or of the ray whereas the mathematical inquiry or the logical method is into their modes of behaviour. Therefore, the scientific spirit as understood in Islamic tradition is more comprehensive than its modern counterpart due to the multiple methods that cover all the possible objects of knowledge within the realm of the cosmos (Sabra, 1989).

Science, as a knowledge field in the study of the physical world, began to be cultivated by Muslims in earnest in the ninth century but its principles and foundations were built upon the scientific attitude and scientific frame of mind inherited from the religious sciences. Their scientific minds were guided by the search for truth and objectivity, a high emphasis on

empirical evidence, classifications, conceptual analysis with emphasis on logical clarity and precision (O. Bakar, 2008). This very modern scientific frame of mind was developed within the religious sciences like Qur'anic exegesis ('ilm tafsīr), principles of legal systems (*uṣūl fiqh*), sciences of the *ḥadīth* ('ulūm al-ḥadīth) and others. For example, within the sciences of *ḥadīth*, in an attempt to preserve the *Sunnah* of the Prophet from extraneous contaminations, wilful mutations and unfounded innovations, the early Muslims introduced the methods of reporting and evaluating, known as the system of the authority (*isnād*) and the system of antecedents of the narrator (*asmā' al-rijāl*). At that time, neither the Greeks nor the Romans, Persians and others were aware of the necessity and utility of the scientific ways of evaluating, recording and preserving historical data (Rauf, 1997). Within the field of *fiqh*, 'ilm al-tafsīr is employed to extract the meaning of the Qur'anic text by employing the rational faculty in analysing the verses that act as data in solving legal issues. This quest requires objectivity as the law deals with both thoughts and actions in human life. The rational faculty is called upon to present and expound on the Revelation in a rational manner to the best degree possible. This extensive use of the rational faculty by the *fuqahā'* did not lead to the kind of rationalism that rejects truth claims which lie outside its cognitive competency as practised by the modern mind. The scientific attitude and frame of mind practised in the Islamic intellectual tradition recognises the limitation of the faculties of knowing²² and used them within the proper domain of competencies. As mentioned in the Qur'an:

He Who has made everything which He has created most good: He began the creation of man with (nothing more than) clay, And made his progeny from a quintessence of the nature of a fluid despised: But He fashioned him in due proportion, and breathed into him something of His spirit. And He gave you (the faculties of) hearing and sight and feeling (and understanding): little thanks do ye give! (The Qur'an 32:7-9)

The interplay between religious consciousness, that comes from the manifestation of *al-tawḥīd* into the realm of knowledge, with scientific attitude becomes visible when Muslim scholars and scientists recognises the limitations of the physical senses as instruments of knowledge despite employing sensual experience as a source of empirical knowledge. The understanding of cosmic unity dictates that there are

phenomena and realities which are beyond the ability of the physical senses even with the aid of tools. Non-physical realities demand other appropriate faculties of knowing and methods to be used.

Scientific Conceptual Tools

Science cannot grow without tools. Science has its own conceptual tools to help scientists understand and interpret the natural world. Some of the conceptual tools like observation and experimentation, definition, logical thinking, mathematical reasoning and rational interpretation were used by the early Muslim philosopher-scientists in their own legitimate ways within their scientific enterprise. If we look at the scientific treaties of famous Muslim philosopher-scientists like *Ibn Sīnā*²³, *Ibn Haytham*²⁴, *al-Bīrūnī*, *Naṣīr al-Dīn al-Ṭūsī*²⁵ and many others in areas of astronomy, geology, medicine and cosmology, we will find them arguing not just on the basis of empirical data obtained from experimentation and observation or rational data but also guided by the revealed data.²⁶ These various sources of data serve to complement and strengthen one another, a consciousness arriving from the manifestation of *tawḥīd*. The Muslim philosopher-scientists devised their 'scientific method' by employing logic and demonstration as the basis of their reasoning in the philosophical sciences and called it *al-burhān* which means demonstration (O. Bakar, 1996). They were very aware of the fact that logic is a double-edged instrument which can serve both truth and error. With the proper use of logic guided with revelation, Muslim scientists of the past were able to ensure overall consistency between what they perceived and what is being revealed and at the same time filter any incoherence and contradictions.

This method of proof, *al-burhān*, employs syllogism or logical reasoning that makes use of premises that are true, primary and necessary. The certain natures of the premises are obtained through empirical data provided by sense perception via observation and experimentation or through rational (intellectual) data through intuition or even spiritual experience (O. Bakar, 1996). This 'scientific method' employed in the Islamic intellectual tradition has a far wider meaning than its modern counterpart. For the purpose of this article, we will focus on three fundamental scientific conceptual tools that have their roots in the Qur'an. These tools are: (i) definition, (ii) observation and experimentation and (iii) logical or rational interpretation.

Definition

Definition is to contain the subject matter that is being discussed. Without definition, terms and concepts will not be understood. Further analysis becomes impossible when the subject matter is not well defined. The spirit of definition is well established in the Qur'an. The Qur'an defines many things by its *rasm*²⁷ or *hadd*²⁸ definition²⁹. An example of these two types of definitions employed in the Qur'an is in relation to the concept of *ṣiraṭ al-mustaqīm* (the straight path). The *rasm* definition is in *surah al-Fātihah* which describes it as "the path of those on whom Thou has bestowed favours and not of those upon whom Thy wrath is brought down nor of those who go astray." (*The Qur'an* 1:7) The *hadd* definition is described as "and that you should serve Me; this is the straight path." (*The Qur'an* 36:61) The Qur'an also showed the importance of definition when new terminologies are introduced in a discussion. Very often, we find the definition of a new concept or term being elaborated immediately in the subsequent verse(s) of the Qur'an. For instance, Qur'an introduced the concept of *ulū al-albāb* (men of understanding) at the end of verse 190 in *surah āli-Imrān* and gave their characteristics in the next verse by saying:

Behold! in the creation of the heavens and the earth, and the alternation of night and day,- there are indeed Signs for men of understanding,- , Men who celebrate the praises of Allah, standing, sitting, and lying down on their sides, and contemplate the (wonders of) creation in the heavens and the earth, (With the thought): "Our Lord! not for naught Hast Thou created (all) this! Glory to Thee! Give us salvation from the penalty of the Fire. (The Qur'an 3:190-191)

In another instance, the Qur'an discusses the concept of successful believers. Immediately after introducing this, an elaboration of the actions and characteristics of a successful believer is described. The Qur'an said:

The believers must (eventually) win through,- Those who humble themselves in their prayers; Who avoid vain talk; , Who are active in deeds of charity; , Who abstain from sex, Except with those joined to them in the marriage bond, or (the captives) whom their right hands possess,- for (in their case) they are free from blame, But those whose desires exceed those limits are transgressors;- Those who faithfully observe their trusts and their covenants; And who (strictly) guard their prayers;- These will be the heirs, Who

will inherit Paradise: they will dwell therein (for ever). (The Qur'an 23:1-11)

With precise definition of terms and concepts, their classification becomes meaningful. The spirit of classification is an important aspect of science as it enables the categorisation of concepts with similar characteristics and patterns that will enable a better presentation of data obtained. This will then aid in the data interpretation process. This spirit of classification is clearly exemplified in the Qur'an. In the beginning of *surah al-Baqarah*, the Qur'an classifies human beings in accordance with their spiritual health, *muttaqūn*, *kāfirūn*, *munāfiqūn* and *mufsidūn* (the Qur'an, 2:1-20). With these classifications, the Qur'an provides the characteristics of these categories of people. For example, the *muttaqūn* are described as:

This is the Book; in it is guidance sure, without doubt, to those who fear Allah; Who believe in the Unseen, are steadfast in prayer, and spend out of what We have provided for them; And who believe in the Revelation sent to thee, and sent before thy time, and (in their hearts) have the assurance of the Hereafter. (The Qur'an 2:2-4).

A characteristic of the *kāfir* is then described as "...it being alike to them whether you (Muhammad) warn them, or do not warn them, they will not believe" (*The Qur'an* 2:6). A *munāfiq* is described as having the characteristics of the "desire to deceive Allāh and those who believe and they deceive only themselves as they do not perceive" (*The Qur'an* 2:9) because they pay heed to the lips without the conviction of the heart. The *mufsidūn* have the nature of not being aware of their actions as causing destruction. Instead they insist that they are the peace builders. As the Qur'an states that:

And when it is said to them: Do not make mischief on Earth, they say: We are but peace makers. Now surely they themselves are the mischief makers but they do not perceive. (The Qur'an 2:11-12).

Another genre of classification that is demonstrated by the Qur'an is the act of drawing the attention of specified groups of people for messages that are pertinent to them. Without doubt, all verses of the Qur'an are addressed to mankind, but the Qur'an calls the attention of a particular group of people at the beginning of specified verses to indicate the extreme relevance and importance of those verses to them.

One of these calls is the phrase 'O humankind' (*yā ayyuhā al-nās*) inviting humankind towards an important message like the call towards the reverence of God who had created this beautiful planet earth for all of us to share and protect. The Qur'an says:

O humankind! Adore your Lord, Who hath created you and those before you, so that you may attain God-consciousness; Who has made the earth a resting-place for you and the sky a canopy; and cause water to pour down from the sky, thereby producing fruits as food for you. And do not set up rivals to God when you know (better). (The Qur'an 2:21-22)

The above verse indicates the important message for humankind to study the universe, learn the essence of creation and acquire responsible authority over the world of nature. At the same time it forbids humankind from the misinterpretation and misuse of such knowledge because by doing so humans are bringing upon themselves destruction and retribution.

In another instance, humankind is invited to be cautious of their intake of food and their dietary habits: "O humankind, eat of what is on earth, lawful and good and do not follow the footsteps of the Evil one, for he is to you an avowed enemy." (*The Qur'an 2:168*) The verse ends by warning humankind of their common enemy who will never surrender to mislead them even in matters related to dietary practices. In another verse, humankind is brought to the attention of the common mechanism of how they are brought into existence through sexual relations and human reproduction:

O humankind! Reverence your Guardian-Lord who created you from a single person, created, of like nature, his mate and from them twain scattered (like seeds) countless men and women; reverence God through whom you demand your mutual rights, and (reverence) the wombs (that bore you): for God ever watches over you. (The Qur'an 4:1)

There are many loaded issues of common interest of humankind in this verse that can be derived. These issues can serve as a starting point for dialogue among the various religious groups as the issues and problems are among all the faiths. However the discussions of these issues are beyond the scope of this article.³⁰

Verses involving acts of worship are targeted towards the believers with the phrase 'O you who believe' (*yā ayyuhā al-ladhīna āmanū*) like in the

verse "O you who believe, fasting is prescribed onto you..." (*The Qur'an 2:183*) Another example is "O you who believe, Obey Allāh and obey the Messenger and the leaders among you..." (*The Qur'an 4:59*) The people of the book (*ahl-al-kitāb*) are also specifically mentioned and called upon towards common spiritual understanding and commitment; the Qur'an says:

Say: O People of the Book! Come to common terms as between us and you: that we worship none but God; that we associate no partners with Him; that we erect not, from among ourselves, lords and patrons other than God. If then they turn back, say ye: Bear witness that we (at least) are Muslims (bowing to God's Will). (The Qur'an 3:64)

The immediate significance of the verse is directed at the members of the three Abrahamic faiths, Judaism, Christianity and Islam. The immediate message points towards the commonality regarding the perception of The Creator that exists between these three religions. The message also refutes hostility of Muslims towards the people of the book (*ahl al-kitāb*) if they decided not to accept the Message. There are other issues that could be used as the starting point for constructive dialogue among the Abrahamic religions, but that discussion is beyond the scope of this article.

Observation and Experimentation

Long before Roger Bacon³¹ (d. 1294 CE) introduced and popularised the experimental method in European science, empirical studies based on observation and experimentation were already widespread in the Muslim world. Such kinds of studies were carried out on far more extensive scales by the Muslims compared to previous civilisations (Rauf, 1997). Roger Bacon was no more than one of the apostles of Muslim science and method to Christian Europe and he was never wearied of declaring that knowledge of the Arabic and Arabian science was for his contemporaries "the only true way to knowledge" (R. Briffault, 1919). Another respectable and famous writer of the history of science Sir James Jeans described Al-Bīrūnī as the person who established science on experience and experiment whereas the Greek science was based on speculations (Siddiqui, 1981).³² On this, Robert Briffault³³ described as:

The debt of our science [western science] to that of the Arabs does not consist in startling discoveries. Science owes a great deal more to the Arab culture; it owes its existence. The ancient world was, as we saw, pre-scientific. The Greeks systematised, generalised

and theorised, but the patient ways of investigation, the accumulation of positive knowledge, the minute methods of science, detailed and prolonged observation and experimental enquiry were altogether alien to the Greek temperament. What we call science in Europe is the result of a new spirit of inquiry, of new methods of investigation, of the method of experiment, observation, measurement, of the development of mathematics in a form unknown to the Greeks. The spirit and those methods were introduced into the European world by the Arabs (R. Briffault, 1977).

Famous Muslim scientists like Al-Rāzī, Ibn Sīnā, Ibn Haytham and many more were all noted for their observational powers and experimental tendencies in their studies of the various fields of natural science.³⁴ The experiential spirit of the Muslims were derived from their sincerity in wanting to practice the commandment of Allah and in ensuring that the public is also able to practice the pillars with ease. Experimentation and observation in astronomy was inspired due to Muslims wanting to know the direction of *qiblah*. Experimentation in time keeping was initiated due to the yearn to fulfil the obligation of the daily prayers and the enthusiasm to perform them on time. Accurate observations of the movements of celestial objects', especially the moon, were recorded to establish the time for *Ramaḍān* and *Hajj*. The Muslim spirit of experimentation and the use of empirical data did not lead them into rebelling against the Absolute. They acknowledged consciously the limitation of their physical senses and simultaneously used them in accordance with their proper nature and functions.

These observational powers are inspired from the Qur'ānic verses that encourage humankind to investigate natural phenomena by using the phrase "do you not see" (*alam tara*). The Qur'ān says: "Do you not see that Allāh created the heavens and the earth with truth..." (The Qur'an 14:19) and in another verse, "Do you not see that Allāh drives along the clouds, then gathers them together then piles them up so that you see rain coming..." (The Qur'an 24:43). These verses and many more similar ones not only encourage humankind to observe nature but to investigate and study nature to discover the inner truths. Another type of verses that encourages close observation are verses that use the word *yanẓuru* (close observation) like "Will they then not investigate how the camels are created, the sky is lifted up and the mountains firmly fixed and the earth made a vast expanse..." (The Qur'an 88:17-20).

The verses mentioned, in our opinion, that call to see, hear and think are not just for the purpose of

experiencing the external sensation of the phenomena but to use these God given cognitive faculties to its fullest potential in understanding the spiritual functions, symbols and inter-relatedness of the phenomena. More importantly, nature is the evidence (*āyāt*) of the Supremacy of God, being the Creators of those wonders. Thus, observation as a tool in science is a Tawḥīdic method that leads to the unveiling of unity in the creation of the cosmos. One must use his senses as guided by the Qur'ān to explore The Truth in nature that brings human to the ultimate idea of *Tawḥīd* (unity and oneness).

Humans were warned that if they were just to use the senses for external sensation only, they are like or even worse than animals that do not possess the intellectual faculty to perform rational and logical interpretation. The Qur'ān says:

"...they have hearts with which they do not understand and they have eyes with which they do not see and they have ears with which they do not hear, they are as cattle, nay they are in worse errors; these are the heedless ones." (The Qur'an 7:179)

Logical or Rational Interpretation

Interpretation is one very important aspect of scientific activity and creation of knowledge. Facts alone will not constitute real knowledge. The next step after data collection is the interpretation of data. The approach and spirit of interpretation of Muslim scientists of the past was influenced by the science of *tafsīr*. The tradition of the interpretation of knowledge was developed after the science of the interpretation of Quran (*'ilm tafsīr*) was developed. As in *tafsīr*, the scientific spirit of interpretation made the Muslims very concerned with the clarity and consistency as with truth and certitude when they were doing data interpretation. The science of *tafsīr* is equally applicable to nature because the book of nature is the macrocosmic counterpart of the Qur'ān. The 8th /15th century Sufi master, 'Azīz al-Nasafī in his *Kashf al-ḥaqā'iq* compares nature to the Qur'ān in such a way that each genus in nature corresponds to a *surah*, each species to a verse and each particular being a letter.³⁵ Therefore a *tafsīr* of the Qur'ān necessarily involves a corresponding *tafsīr* of the phenomena of nature which can develop into symbolic interpretation of nature that requires the science of *ta'wil* as how some Qur'ānic verses requires interpretation that goes beyond the external and rational meaning (O. Bakar, 2008).

An important aspect of interpretation in science is objectivity³⁶. Objectivity carries the meaning of

“based on real facts and not influenced by personal beliefs or feelings”³⁷ or “senses relating to objects, their function, and perception”³⁸. It is an essential element of the scientific spirit. In Islamic intellectual tradition, the quest for objectivity is not confined to the empirical and experimental domain.³⁹ This quest includes the objective quest of the different levels of meanings in nature that provides spiritual and symbolic understanding to human. This is a logical consequence of Islam's comprehensive understanding of the manifestation of The Real at the various levels of beings. Therefore, to understand inner truths in nature, an accompanying intellect reasoning must be employed together with the external senses. This is due to the inability of humans to perceive the many realities of the physical world.⁴⁰ With regards to the need of intellect reasoning for logical interpretation of the data collected from the external senses, the Qur'an says:

He it is who sends down water from the heaven for you, it gives drink and by it [grow] the trees upon which you pasture. He causes to grow for you thereby herbage and the olives and the palm trees and the grapes and of all the fruits, most surely there is a sign in this for people who reflect (yatafakkarūn). (The Qur'an 16: 10-11)

In another verse the Qur'an says,

And He has made subservient for you the night and the day and the sun and the moon and the stars are subservient by His commandment; most surely there are signs for those who ponder (ya'qilūn). (The Qur'an 16:12)

The Qur'an continues in another verse with regards to the importance of rational interpretation that originates from the senses,

And He it is Who has brought you into being from a single person, then there is [for you] a resting place and a depository indeed. We have made plain the signs for a people who understand (yafqahūn). (The Qur'an 6:98)

The use of the word such as *tafakkur*, *ta'qul*, *tafaqquh* in the above verses and other verses indicate the different shades of emphasis of the cognition process that accompanies external senses in understanding the universe.⁴¹

And God has brought you forth from the wombs of your mother [in a state where] you did not know

anything and He gave you the hearing and the sight and the hearts [al-af'idah, singular: fu'ād]. (The Qur'an 16:78)

Objectivity in interpretation also requires the interpretations to be open to public scrutiny in order to verify the impartiality of interpretation. Islamic intellectual tradition do not set the number of people capable to access or verify the interpretation as the only criteria of objectivity⁴² but uses the idea of a particular form of verification or proof corresponding to the nature of the faculty of knowing through which the objective truth is cognized (Bakar 2008, p.8-11).⁴³ Therefore the Qur'an exhorts the believers to scrutinise the claims of truth to ensure its objectivity so as to facilitate towards the arrival of certitude. The Qur'an says:

“O you who believe! Stand out firmly for Allah, as witnesses to fair dealing, and let not hatred of others to you make you swerve to wrong and depart from justice. Be just, that is next to piety and fear Allah; for Allah is well acquainted with all that you do.” (The Qur'an 5:8).

The Qur'an warns humans on the impediments of objectivity when interpretations and judgements are being made. These obstacles of objectivity can overrule the intellect and prevent it from functioning properly. To suppress the subjectivity that arises from these impediments, we are required to shake our minds of unfounded prejudgements and suppositions. Instead, we must open up the mind towards the possibility of approaching truth in the quest of studying nature. The Qur'an says, “They rejected what they did not know while they had not access to its interpretation”. (The Qur'an 10:39). In another verse, the Qur'an emphasise the danger of the impediments to rationality by saying:

Have you then considered him who takes his low desire for his God and Allāh has made him err, having knowledge and has set a seal upon his ear and his heart and put a covering upon his eye. Who can then guide him after Allāh? Will you not then be mindful? (The Qur'an 45:23)

Conclusion

Our whole discussion in this paper focused on the centrality of the Qur'an and its intimate link to the development of the scientific spirit. The scientific conceptual tools of definition, observation and experimentation and logical interpretations are highly visible in the messages of the Qur'an to humanity. The world of nature must not be pursued as an end in

itself but must be seen to possess rich spiritual and symbolic messages that are meant for humans to reflect and ponder upon. Scientific conceptual tools understood and applied from the Tawhīdic perspective provides a comprehensive method in studying nature where the different levels of intended meanings and knowledge can be obtained from nature. The use of the different cognitive faculties bestowed upon man is employed to understand the different hierarch of realities created in nature. The focal point of the messages of the Qur'an on the universe, as the signs of God (*āyāt Allāh*), leads human to the beautiful and harmonious understanding and manifestation of God's beauty, wisdom, beauty, greatness and His Unity (*al-tawhīd*). From this simple concept of the Oneness of the Creator, believers of the religion are required to seek knowledge in affirming the Oneness of His Essence, Attributes and Qualities through His diverse creations that will ultimately return and point towards Him. The Qur'an encourages the study of the physical phenomena to unlock its inner truths. The Qur'an provided the way on how to use the appropriate tools and methods during the investigation. In the Islamic intellectual tradition, the Muslim philosophers-scientists followed the injunction of the Qur'an in conducting their investigation and study of the natural world. They employed what has been regarded as 'modern' scientific methods as we understood now with such precision and accuracy that their achievements showed the perfect harmony of revealed text with logical and rational interpretation. They demonstrated the capacity of a religious text in inspiring scientific spirit and shaping a scientific mind which seems impossible through the minds of those for whom science is identified with a particular mode of knowledge which have reduced the reality of nature to just her physical aspects.

On the other hand, its modern counterpart views the study of nature as an end by herself. There is no more to nature than can be analysed in purely physical terms and a search for an understanding of the spiritual and symbolic meaning is a vain, unscientific and subjective pursue. The study of nature in contemporary settings is only concerned with the exploration of the properties of matter in its various forms because matter is the be-all and end-all of science. There is no doubt that the material scientific achievements of modern science are far reaching than the past civilisations but when examined more minutely, they lose their initial lustre.

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- Article history**
Received: 01/09/2014
Accepted: 03/06/2015
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- ¹ Here we are looking at the Muslim scientists prior to and during the golden era (8th to 12th century) of the Islamic Civilisation.
- ² When used with the prefix *al*, the concept *tawhīd* exclusively refers to 'the Unity of Allah'. Without the prefix, it denotes unity.
- ³ "We will soon show them Our signs in the universe and in their own souls until it will become quite clear to them that it is the truth..." The Qur'an, 41: 53.
- ⁴ The Qur'an is known with several other names like *al-Mizān* (The Scale), The Qur'an, 57:25; also called by *al-Furqān* (The Criterion), The Qur'an, 2:185 and The Qur'an, 25:1; also called by *al-Hudā* (The Guidance), The Qur'an, 2:2 and The Qur'an, 6:38; also called by *al-Muhaimīn* (The Guardian), The Qur'an, 5:48; also called by *al-Dhikr* (The Remembrance), The Qur'an, 15:9; also called by *al-Kitāb* (The Book), The Qur'an, 2:2.
- ⁵ "We have, without doubt, sent down the Message and We will assuredly guard it", The Qur'an, 15: 9.
- ⁶ In Islamic intellectual tradition, the cosmos or the universe (*al-'ālam*) is defined as "everything other than God" (*mā siwa Allāh*). In the Qur'an, the phrase "lord of all the worlds" (*rabb al-'ālamīn*) is mentioned repeatedly and Muslims mentioned this phrase at least 17 times daily in their daily prayers. Another often repeated phrase is "everything in the heavens and the earth" (*mā fī al-samāwātī wa al-arḍ*) and "what is in between" (*wa mā baina humā*) is the sum total of everything other than God is considered as the cosmos. See Seyyed Hossein Nasr, *An Introduction to the Islamic Cosmological Doctrines: Conceptions of Nature and Methods Used for Its Study by the Ikhwān al-Safā, al-Bīrūnī and Ibn Sīnā* (rev. ed.) (Albany: State University of New York Press, 1993).
- ⁷ Without doubt, there are other principles that proceed from the principle of Unity of God. For example, the principle of unity of mankind where the Qur'an mentioned about the beginning of mankind as a single nation, bound together by the belief of the oneness of God. The Qur'an says: "All people are a single nation; so Allāh raised prophets as bearers of good news and as warners and He revealed with them the Book with truth." The Qur'an: 2:213. Another important principle that proceeds from the Unity of God is the principle of oneness of morality. Since God is one and mankind is also one, the moral code must also be one. For a comprehensive discussion on these two forms of unity see Kabuye Uthman Sulaiman 'Islamic Civilisation: Meaning, Origin and Distinctive Characteristics' in *Islam Knowledge and Civilisation* (International Islamic University of Malaysia: International Islamic University of Malaysia Press, 2009), pp. 86-88.
- ⁸ Three Arabic terms are widely used to denote cosmos where physical nature is part of it. The terms are *al-'ālamīn*, *al-khalaq* and *al-kawn*. The word *al-'ālamīn* occurs seventy-three times in the Qur'an where the singular *al-'ālam* does not occur. The word *khalaq* is mentioned fifty-two times in the Qur'an and the word *al-kawn* as a noun does not appear in the Qur'an but its verb form *kāna* appears 1358 times. For a detail explanation of these terminologies and their significance and variations of usage

in the Qur'an and the implications to the Islamic intellectual traditional view of nature, see Osman Bakar, 'Cosmology and the Models of the Cosmos: Classical' in Ibrahim Kalin (ed.), *The Oxford Encyclopedia of Philosophy, Science and Technology in Islam* (UK: Oxford University Press, 2014), pp. 156-163.

⁹ The Qur'an, 54:49; The Qur'an, 11: 6; The Qur'an, 36:38-40.

¹⁰ The term *al-haqq* is mentioned in the *Qur'an* one hundred and ninety four times with variant meanings. However, when it is used in relation to *Allāh* it means 'The Reality that is Eternal'. See Majma' al-Lughah al-'Arabiyyah, *Mu'jam al-fāz al-Qur'an al-Karīm* (Cairo: Al-Idārah al-'āmmah li al-Mu'jamat wa Ihyā' al-Turāth, 1988), p. 307.

¹¹ "If there were, in heavens and the earth, other gods besides God, there would have been confusion in both." The Qur'an, 21:22.

¹² The created universe is described as a cosmic revelation and a book of God whose uncreated reality has been called *al-Qur'an al-takwīnī*. This idea originates from the *ḥadīth qudsī* that states that God want to be known, therefore He creates the Universe. This implies that God's creation is also His revelation for otherwise it would be impossible for Him to be known from creation.

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<http://www.oed.com/view/Entry/172672?redirectedFrom=science#eid>, accessed on 17th July 2014

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<http://dictionary.cambridge.org/dictionary/british/science?q=science>, accessed on 17th July 2014.

¹⁶ *Webster's New World Dictionary of the American Language* (Cleveland and New York: The World Publishing Company, 1962), p. 1305.

¹⁷ *Ma'rifah al-shay' 'alā mā huwa bih*. For a collection of definitions of 'ilm used by classical Muslim scholars, see Franz Rosenthal, *Knowledge Triumphant: The Concept of*

Knowledge in Medieval Islam (Leiden: E.J. Brill, 1970), pp. 46-69.

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¹⁹ Perez Hoodbhoy listed a glossary of terms and their explanations that need to be understood prior to understanding the scientific methods. The terms are fact, laws, theory, induction and deduction. See Perez Hoodbhoy, *Islam and Science: Religious Orthodoxy and the Battle for Rationality* (London and New Jersey: Zed Books Ltd, 1991), pp. 8-12.

²⁰ In Islamic tradition, the nature of the object of knowledge is known as ontological status of objects of knowledge. The ontological reality of the object is dependent on the hierarchy of beings (*martabat al-mawjūdāt*). For a discussion on this subject see *Essentials of Islamic Epistemology*, pp. 38-60.

²¹ Sabra (ed. & Trans), *The Optics of Ibn Haytham* (London: The Wayburg Institute University of London, 1989), p. 277. Here in after cited as *The Optics of Ibn Haytham*.

²² Human are given five external senses with its corresponding five internal senses. He also has the rational and spiritual faculties. See Fazlur Rahman, *Avicenna's Psychology* (Westport, Connecticut: Hyperio Press, Inc., 1981, reprint). On al-Fārābī's psychology, see Osman Bakar, *Classification of Knowledge in Islam* (Kuala Lumpur: International Institute of Islamic Thought and Civilisation, 2006), pp. 48-64. On Ibn Khaldūn hierarchy of faculties of knowing see Ibn Khaldūn, *The Muqaddimah* Vol 1, trans. Franz Rosenthal (London & Henley: Routledge & Kegan Paul, 1967), pp. 194-202.

²³ For example see See Ibn Sīnā, *Al-Shifā': Al-Simā'a Al-Tabī'ī* (*The Physics of Healing*) trans Jon McGinnis (Provo Utah: Brigham Young University Press, 2009).

²⁴ See *The Optics of Ibn Haytham*.

²⁵ See Toby Huff, *The Rise of Early Modern Science: Islam, China and the West* (Cambridge: Cambridge University Press, 1993), p. 57.

²⁶ For a comprehensive treatment of this subject see Seyyed Hossein Nasr, *Islamic Science: An Illustrated Study* (London: World of Islam Festival Publishing Co., 1976). Here in after cited as *Islamic Science: An Illustrated Study*.

²⁷ *Rasm* definition is a description of the nature or characteristics of the object being defined.

²⁸ *Hadd* definition is a definition that sets a precise or concise limit specifying the distinctive characteristic of what is being defined.

²⁹ For a comprehensive treatment and discussion on these two types of definitions, see Syed Muhammad Naquib al-Attas, *Prolegomena to the Metaphysics of Islam: An Exposition of the Fundamental Elements of the Worldview of Islam* (Kuala Lumpur: International Institute of Islamic Thought and Civilisation, 2001), pp. 111-124.

³⁰ Some issues of contemporary concerns are on the treat of the institution of marriage and family and the growing practice of disrespect of the womb by turning it into 'science laboratories'.

³¹ Roger Bacon was an English philosopher and Franciscan friar who placed considerable emphasis on the study of nature through the empirical method in Medieval Europe. He is sometimes credited as one of the earliest European advocates of the modern scientific method inspired and taken from Aristotle and Muslim scientists.

³² Hafeezur Rahman Siddigui, *The Contribution of Muslim Scientists*, Article for Hijra Conference, vol 8, published 1981, Islamabad. Quoted in Munawar Haque, 'Contribution of Muslim Scholars to the Sciences' in *Islam Knowledge and Civilisation* (International Islamic University of Malaysia: International Islamic University of Malaysia Press, 2009), p. 132.

³³ Robert Briffault was trained as a surgeon, but found fame as a social anthropologist and in later life as a novelist. His was born in 1876 and died in 1948. He is known for his Briffault's Law which states that "the female, not the male, determines all the conditions of the animal family. Where the female can derive no benefit from association with the male, no such association takes place." Quoted from http://en.wikipedia.org/wiki/Robert_Briffault accessed on 22nd July 2014.

³⁴ For a comprehensive exposition of the achievements of the Muslim scientists see Seyyed Hossein Nasr, *Science and Civilisation in Islam* (2nd Ed.) (Cambridge: The Islamic Text Society, 1987). See also his *Islamic Science: An Illustrated Study*.

³⁵ F. Meier, 'Nature in the Monism of Islam' in Joseph Campbell (ed.), *Spirit and Nature* (Princeton, 1982), pp. 202-203 as quoted in *Tawhid and Science*, p. 34 footnote 33.

³⁶ For a comprehensive discussion on the problems of objectivity in science as understood in modern contexts see *Essentials of Islamic Epistemology*, pp. 78-84.

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<http://dictionary.cambridge.org/dictionary/british/objective> accessed on 23rd July 2014.

38

<http://www.oed.com/view/Entry/129634?redirectedFrom=objective#eid> accessed on 23rd July 2014.

³⁹ The discussion on different levels of objective truth is closely linked to the hierarchy of realities as discussed by Muslim philosopher-scientists in the Islamic intellectual heritage. It involves the concept of ontological status of the object of knowledge and how these different objects of knowledge can be known through the different human faculties. For a philosophical discussion on this subject refer to Mulyadhi Kartanegara, *Essentials of Islamic Epistemology*, (Brunei Darussalam: Universiti Brunei Darussalam Press, 2014). Read specifically chapters 4,5 and 6.

⁴⁰ Allāh is He who raised the heavens without any pillars you see." (The Qur'an, 13:2); In another instance, Qur'an emphasises this point by saying "But nay! I swear by that which you see, and that which you see not." (The Qur'an, 69: 38-39); "Glory be to Him who created pairs of all things, of what the earth grow and of their kind and of what they do not know." (The Qur'an, 36:36).

⁴¹ For an explanation on the different usage of these terms refer to Mehdi Golshani, *The Holy Qur'an and the Sciences of Nature* (Revised 3rd edition), (Selangor: Amin Research and Cultural Centre), pp. 125-136.

⁴² In the modern world, empirical knowledge is deemed the only objective form of knowledge since it is this type of knowledge that is accessible to and verifiable by most people.

⁴³ *Tawhid and Science*, pp. 8-11.