

Harmony of Science and Religion A Complementarity Perspective

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Abstract

The principle of complementarity, first invoked to account for certain phenomena in quantum mechanics, is reviewed as an aid in understanding the nature of the harmony between science and religion. The close affinity between this principle and 'Abdu'l-Bahá's views concerning internal and external reality is explored, and the support the principle lends the Bahá'í tenets concerning the unity of mankind and the oneness of religion is outlined.

Résumé

Le principe de complémentarité, invoqué á l'origine pour expliquer certains phénomènes de mécanique quantique, est ici examiné pour aider á comprendre la nature de l'harmonie entre la science et la religion. L'auteur explore ensuite l'affinité entre ce principe et les vues d' 'Abdu'l-Bahá concernant la réalité interne et externe, puis il esquisse l'appui apporté par ce principe á la doctrine bahá'íe sur l'unité de l'humanité et l'unité des religions.

Resumen

El principio de complementativa, usado por primera vez para explicar ciertos fenómenos en la mecánica quantum, es repasado como una ayuda al entendimiento de la naturaleza de la armonía entre la ciencia y la religión. Se va a explorar la afinidad entre este principio y los puntos de vistas de 'Abdu'l-Bahá concerniente a la realidad interna y externa y, se delinea el apoyo que el principio presta a las creencias Bahá'í concernientes a la unidad de la humanidad y la unicidad de la religión.

Introduction

That there must be harmony between science and true religion¹ is an important tenet of the Bahá'í Faith. In this paper the principle of complementarity, originally enunciated by Niels Bohr,² is employed to shed light on the logical foundation of this harmony. The complementarity principle states, in effect, that two concepts or viewpoints concerning a given aspect of reality that may appear mutually exclusive and irreconcilable do not necessarily conflict and, indeed, may together represent a reality deeper than that conveyed by either alone, or by the two simply added together.³ In following sections this principle is illustrated by a simple geometric analogy tailored to reflect the harmony of science and religion. As well, the paper explores a conjoining of views of 'Abdu'l-Bahá and Bohr that suggest a rationale for still wider unity.

The concept of complementarity first arose in studies of quantum mechanical entities such as light and the electron, which manifest themselves as particle-like in some experiments and wave-like in others. It is now well established that it is the fundamental nature of these entities that neither the particle nor the wave description is reducible to the other, nor are they both reducible to some deeper representation. Rather, both must be accepted as conveying true and nonconflicting aspects of a reality that can be visualized in no better way.⁴ In practice, the physicist is able to work with either concept of the entity as required and can translate from the one to the other by well-established rules of translation (equations) without conflict or ambiguity.

It was Bohr's conviction that this complementarity of the wave and particle descriptions of submicroscopic objects illustrated a general property of reality that had not been previously appreciated, and he advocated its application in understanding the relationship of many apparently irreconcilable concepts in the macroscopic world.⁵ However, after decades of exposure to critical examination, this principle has not achieved complete acceptance as a universal law.⁶ If we examine the viewpoints of various authors who have discussed the application of complementarity to matters outside quantum mechanics including especially the science/religion question, we find a broad spectrum ranging from a rigorous philosophical approach (in which an attempt is made to identify the essential elements of quantum mechanical complementarity and then to specify rigid tests to decide its applicability in other situations) to more relaxed views (in which one applies the principle generally and uncritically to a wide variety of situations).⁷ Thus, just how strictly the principle can, or should, be interpreted in applications in the macroscopic

world is far from clear. In trying to understand this state of affairs, the following views of D.M. MacKay are illuminating:

Complementarity stands not for a physical theory, still less for a mystical doctrine, but rather it stands for a particular kind of logical relation, distinct from and additional to traditional ones like contradiction, synonymy, or independence; it demands to be considered along with others whenever there is doubt as to the connection between two statements...the logical possibility of complementarity imposes additional obligations on anyone who wants to argue that two statements about the same situation are not compatible. (*Zygon* 226-27)

An essential element of complementarity stressed by MacKay is that the disparate descriptions involved must arise from different standpoints for which each view is separately valid. All things considered, it would seem that while complementarity can aid our understanding of the harmony between science and religion, it cannot be assumed that the principle carries the authority of law, nor does its successful application imply a frozen relationship such that the two disciplines cannot evolve or grow closer together.⁸

Before examining the complementarity of science and religion, we would do well to remind ourselves of the range of ideas conveyed by the terms "science" and "religion." Both terms are very broad and can mean different things to different people and different things at different times in the same discussion. For example, "religion" can mean the acknowledgment of the existence of God; or the experience of, or sensitivity to spiritual matters, including impressions of unity, oneness, form, and beauty; or it can mean the sacred teachings of a prophet of God; or the moral guidance and other practical personal and social consequences distilled from those teachings; or any combination of all these things. Similarly, "science" can denote the scientific method, the fundamental advances of science (data, concepts, theory), the applications of science, or combinations of all these.

Other terms that will be used frequently below require some clarification. *Physical reality* will be used to refer to objective experience, i.e., everything accessible in principle to study by science. *Spiritual reality* will be used to denote subjective experience, including aesthetic awareness as well as all the subtle perceptions that are part of religious experience. The term *world* will denote everything humanly perceivable, i.e., the totality of physical and spiritual reality. Physical reality is the domain of science and spiritual reality the domain of religion.

Complementarity Applied

Let us next identify which aspects of the two disciplines might enjoy the complementarity relationship.⁹ First of all, since God is unknowable in essence and not directly a consideration in science in any case, we cannot entertain complementary views concerning Him. Second, I think we must accept that there is only one creation, one ultimate reality, one world, with which both science and religion are concerned although they may reflect different aspects of this one reality. In regard to this common underlying world itself, there can be no question of conflict; at that level, there can only be unity. Third, it is important to note that the two disciplines share much of the same methodology. William Hatcher¹⁰ has pointed out that scientific method is used in religion, especially in the Bahá'í Faith, and that reason and faith are aspects of the same pathway to knowledge followed in both disciplines. It can also be argued that the insight a scientist gains in the course of his or her work comes in a flash, in other words, a kind of revelation similar to the way in which knowledge is gained in religion and that the elation and reverence often felt by a scientist is related to a religious experience. To quote Einstein:

You will hardly find one among the profounder sort of scientific minds without a religious feeling of his own....His religious feeling takes the form of a rapturous amazement at the harmony of natural law, which reveals an intelligence of such superiority that, compared with it, all the systematic thinking and acting of human beings is an utterly insignificant reflection. This feeling is the guiding principle of his life and work....It is beyond question closely akin to that which has possessed the religious geniuses of all ages. (*Ideas and Opinions* 40)

All these observations ring true; religion and science have much in common, particularly insofar as they are concerned with the same underlying reality and share much common methodology and experience. But still large differences remain; the two disciplines have different orientations and, approaching the world from different standpoints, have developed different worldviews. Scientists tend to disbelieve or, more precisely, to practice open-minded skepticism; they experiment, analyze, and build theories toward a worldview centered on physical reality, which they (or their engineering colleagues) apply to mankind's material advantage. By contrast, religious people tend to believe firmly in a given synthesis, a worldview centered in spiritual reality and human values, which they acquire

by revelation from a prophet of God, and they imbibe and interpret its message and apply this to mankind's spiritual and social advantage.

It is in these worldviews where conflict can occur and where we will benefit from applying the ideas of complementarity. We shall therefore focus on worldviews (viewpoints) to the exclusion of other aspects that might be covered by science and religion.¹¹

Geometric Analogy

Let us imagine the world to be a large, complicated building or edifice¹² and that we need to know and understand it so that we can better live with it. Let us also imagine we need a good set of drawings for this world edifice to aid us in visualizing it; these should be good architectural drawings in plan and elevation. We note a simple but important property of plan and elevation views. If one examines an architectural drawing of the façade of a building, one gains little, if any, idea of the layout of the rooms or of the contents in the rooms, i.e., the plan. However, if one looks only at the plan drawing, one learns almost nothing of the form of the building in elevation. Of course, the same architect was involved in both drawings, and on this basis one can do some guessing and form some theories about the other projection in each case, but there are few reliable clues. The two projections are orthogonal and irreducible one to the other, and each contributes essentially no information in the domain of the other. This is an easily understood demonstration of a situation in which two mutually exclusive views of something can exist side by side and not conflict in the slightest, and, moreover, both are essential for us to grasp a reality greater than either view alone can convey.

Now, let us identify the elevation view, the view that shows the whole integral form and beauty of the edifice from top to bottom, with spiritual reality and identify the architectural sketch representing that view with religion. Let us also identify the organization or layout of the parts of the edifice in plan with physical reality and the corresponding detailed and accurate plan drawing with science. Since the earliest times, man has received, through revelation, elevation drawings of the form of this edifice—the farther back in time, the greater the distance of the viewer from the edifice and the cruder the elevation view that was appropriate to his situation. Later, as humanity grew more mature, religions viewing the edifice from closer at hand could use much more detailed and sophisticated renditions of the edifice. Moreover, each religion looked at the edifice from a different side, i.e., from a different viewpoint around the building. But all of these elevation views were true inasmuch as each depicted the overall form and beauty of the edifice from its own restricted viewpoint, i.e., the place in history, culture, and state of development, of the people involved. Even the primitive views were in this sense true.

This analogy fits perfectly with the Bahá'í concept of progressive revelation—that the basic principles of all the great religions are of divine origin and that their teachings are different facets of the same truth, although there may be differences depending on the state of development of the peoples to whom they were originally addressed. In the words of Bahá'u'lláh:

These principles and laws, these firmly-established and mighty systems, have proceeded from one Source, and are the rays of one Light. That they differ one from another is to be attributed to the varying requirements of the ages in which they were promulgated. (*Gleanings* 287-88)

Now in recent times humanity has moved close enough to the edifice to deduce some good plan views as well. We might imagine we've gotten close enough for scientists to tunnel under the edifice and pass probes up through the floor to take measurements of the layout of the rooms and readings of the contents in the rooms. This process is incomplete, as they are always finding more rooms and more levels piled upon levels and can never exhaust the detail of the contents in each room. From the incomplete information they collect, they form theories about the nature of the layout of the edifice and use these to improve our plan drawing, i.e., our science.

The important point illustrated by the analogy is that the plan view of the world need not, indeed should not, conflict with the elevation views. There could be conflict only if someone too literally regards details of the elevation inferred from the plan, or conversely, as 'Abdu'l-Bahá puts it:

If religious beliefs and opinions are found contrary to the standards of science, they are mere superstitions and imaginations; for the antithesis of knowledge is ignorance, and the child of ignorance is superstition. (*Promulgation* 181)

Let us digress to consider another illustration of complementarity in the macroscopic world. To quote Harold Townes:

Niels Bohr has already suggested that perception of man, or any living organism as a whole, and of his physical constitution represents this kind of complementarity. That is, the precise and close examination of the atomic makeup of man may of necessity blur our view of him as a living and spiritual being. (*Zygon* 310)

Thus, an individual is his physical being, which can be described in minute detail by medical science, and at the same time is a spiritual being. So for the human being, as for the electron, we have two complementary descriptions, neither of which alone exhausts what we perceive of the person and, moreover, the person constitutes a unity greater than is represented by simple addition of the two descriptions. ‘Abdu’l-Bahá seems to be encouraging such analogies when he says:

...you will find the smallest atoms in the universal system are similar to the greatest beings of the universe. It is clear that they come into existence from one laboratory of might under one natural system and one universal law; therefore, they may be compared to one another. (*Some Answered Questions* 182)

Townes brings out another aspect of complementary entities in the above statement. To translate to the science-religion situation, he is saying that if one is immersed in physical reality, then spiritual reality tends to recede into the background, and the converse is true. It’s as if we can only focus sharply on one of the complementary perceptions at a time.

To return to our edifice, everything we have considered so far has to do only with the static structure of the world. What happens when we consider the flow of time; what can be said about the dynamic view of the edifice? Then the scientific plan view reveals process, cause and effect, change under the laws of nature, as particularly evident in cosmology and evolution, for example. These can be studied by scientists without any consideration in regard to purpose. From the viewpoint of science, the whole process can be explained as a happening obeying natural law without any clear evidence for design. A scientist might certainly suspect design, but he cannot prove it. The astrophysicist, Fred Hoyle, reflected this when he said “the universe is a put up job” (qtd. in P. Davies, *Superforce* 223); but he cannot prove that it is. Then religion, in the vertical view, reveals purpose, plan, and divine design. Viewers using this projection see God’s hand at work everywhere but are little concerned with the actual mechanisms for carrying out the purpose, with the detailed operations of the laws of nature and cause and effect.

Again, if the analogy holds true, the dynamic views are complementary and need not conflict. Neither view presents the whole story, and the closest we can come to a complete understanding requires that we comprehend both.

It is worth noting in passing another vision of the promise latent in the concept of complementarity:

It is conceivable that the notion of complementarity offers a method of including both sensuous and intellectual knowledge of nature in a common frame of reference. The result, far more than a mere compromise or amalgamation of the two viewpoints, could be a richer science, in which esthetic and quantitative valuations each retaining its own integrity, would contribute equally to the description of nature that science alone took for its province. Further, it may produce a scientific ethic that is less destructive toward nature. (T. Blackburn, *Science* 1003)

Thermodynamicist Ilya Prigogine, further brings out the idea already mentioned several times above that complementarity points to a richer truth:

...the world is richer than is possible to express in any single language...we cannot condense into a single description the various aspects of our experience. We must call upon numerous descriptions, irreducible one to the other, but connected to each other by precise rules of translation. (*From Beginning* 51)

Bahá’u’lláh says much the same thing in regard to the impossibility of completely comprehending or expressing the subtleties of ultimate reality:

Behold, how many are the mysteries that lie as yet unravelled within the tabernacle of the knowledge of God, and how numerous the gems of His wisdom that are still concealed in His inviolable treasures!...The domain of His decree is too vast for the tongue of mortals to describe, or for the bird of the human mind to traverse; and the Dispensations of His providence are too mysterious for the mind of man to comprehend. (*Kitáb-i-Íqán* 167)

‘Abdu'l-Bahá and Bohr

Bahá'ís may well ask themselves whether there is any presage of the notion of complementarity in the Bahá'í writings. I do not know of any direct reference, but the thinking of ‘Abdu'l-Bahá on a closely related matter seems highly relevant. In *Some Answered Questions* he devotes considerable discussion to the question of how forms and symbols of everyday language must be used to convey intellectual (i.e., nonsensory ideas) his purpose being to explain how it is that such devices as metaphor and allegory are the only possible ways to express certain religious concepts for which there is no direct mode of expression. He points out that there are two kinds of knowledge corresponding to two kinds of realities. On the one hand, there is sensible knowledge, i.e., knowledge gained through sensory input, which is knowledge about external reality. On the other hand, there is intellectual knowledge, which is concerned with internal realities such as happiness, grief, love, the inner qualities of man, and the human spirit, which are all things we know about but are not accessible through the senses. To express internal realities one has, in the end, no choice but to use images from external reality because “in the exterior world there is nothing that is not sensible.” (83)

It is interesting that ‘Abdu'l-Bahá makes specific reference to the concept of the luminiferous ether which he includes in the intellectual category because it is not directly sensed but is a construction of the intellect to account for observed phenomena. He states:

Even ethereal matter, the forces of which are said in physics to be heat, light, electricity and magnetism, is an intellectual reality, and not sensible. (*Some Answered Questions* 83-84)

That was written within a year of Einstein' s special theory of relativity which, prompted by the definitive null experiment of Michelson and Morley, explained how the concept of a stationary ether, in which light waves propagate and through which the earth moves, is not verifiable by any optical experiment.¹³ ‘Abdu'l-Bahá also asserts that nature “in its essence” is an intellectual reality.

How are ‘Abdu'l-Bahá's ideas related to our concepts of physical and spiritual reality, which are the domains of science and religion? To attempt to answer this it seems to me we must assume that his category of sensible knowledge must include information conveyed through extensions of our senses, i.e., through aids of all kinds ranging from contact lenses to complicated instruments, and his external reality, therefore, must include phenomena brought to light by such aids. The interconnection between sensible and intellectual knowledge, on the one hand, and science and religion, on the other, together with the domains of reality with which they are associated, might then be roughly represented as in Figure 1.

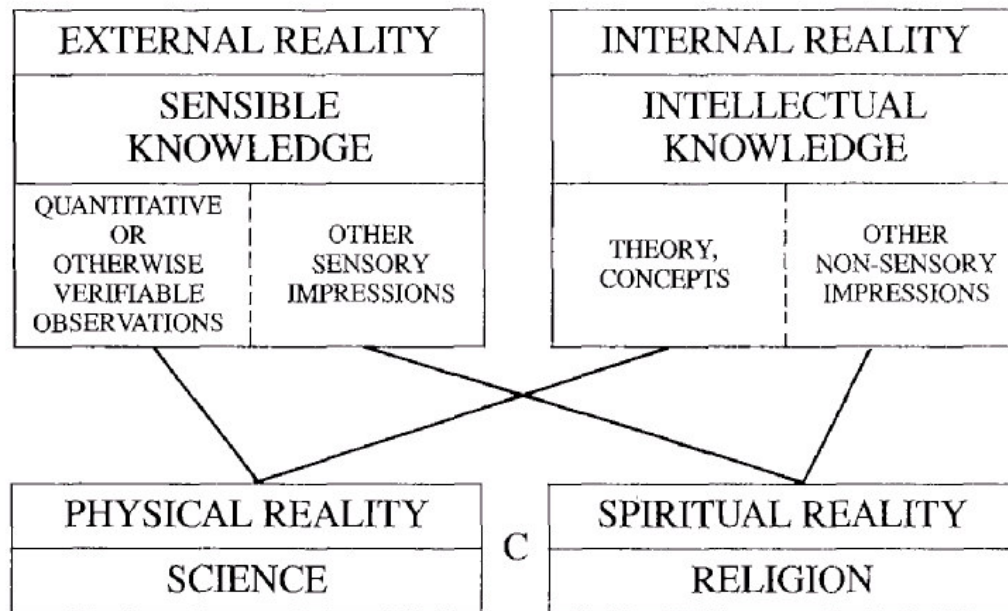


Fig.1 Relationship of ‘Abdu'l-Bahá's categories of sensible and intellectual knowledge to the domains of science and religion

Physical reality takes from sensible knowledge those observations that can be compared quantitatively or otherwise verified by different observers and takes from intellectual knowledge those ideas that organize and explain these observations, i.e., our theories and concepts. Spiritual reality is grounded in nonverifiable, subjective, sensory knowledge together with intellectual knowledge such as emotions, inner qualities, and spiritual experience. Information also flows between the subdivisions under both external or internal reality as the broken-line vertical partitions suggest. For example, regard for truth presumably has its origin largely in the “other nonsensory” subcategory of internal reality but is applied in the “theories and concepts” area as well. It should be noted that this representation does not simply divide the world into objects and nonobjects; insofar as any object may have both verifiable (objective) and nonverifiable (subjective) attributes, it will be manifest in both physical and spiritual reality and thus may (although not necessarily) be articulated in both science and religion. At the bottom of Figure 1, the complementarity relationship between the viewpoints of science and religion is represented by the interconnection C.

Let us return to ‘Abdu’l-Bahá’s point that we are obliged to express intellectual concepts in the language of sensory experience, which is the reason for the obscure language of metaphor, analogy, and parable so prevalent in religion. This is closely related to Bohr’s view on how science must be presented. It was his view that the language used to express experimental conditions and discuss results in quantum physics was necessarily everyday language suitably refined to take the form of classical dynamics. To quote Bohr:

...however far the phenomena transcend the scope of classical physical explanation, the account of all evidence must be expressed in classical terms. The argument is simply that by the word “experiment” we refer to a situation where we can tell others what we have done and what we have learned and that, therefore, the account of the experimental arrangement and of the results of the observations must be expressed in unambiguous language with suitable application of the terminology of classical physics. (*Niels Bohr* 153)

It does not seem a big step from saying that phenomena must be elucidated in unambiguous language of classical physics to saying that they must be expressed in everyday language relating to external, objective reality, which would be ‘Abdu’l-Bahá’s view. Using the same reference to classical physics, Bohr expressed the complementarity principle in yet another way as follows:

Any given application of classical concepts precludes the simultaneous use of other classical concepts which, in a different connection, are equally necessary for the elucidation of the phenomena. (Qtd. in J. Wheeler, *Physics Today* 30)

Translating to ‘Abdu’l-Bahá’s terminology, this suggests that complementarity may be invoked in reconciling mutually exclusive descriptions (expressed in objective, everyday language) of the same intellectual concept. The descriptions are understood to arise in different “connections,” i.e., from different standpoints. To take again the familiar example of the electron, which is an intellectual concept, we use complementarity to reconcile the wave and particle descriptions, which are both classical, everyday, objective representations arising from different experimental conditions (standpoints). This is not unlike the situation that adherents of different religions face when trying to reconcile their apparently-conflicting accounts (expressed in objective, everyday language) of spiritual experiences, revelations, and associated intellectual concepts, each account being colored by the adherents’ particular historical and cultural standpoint. Hence we find support for the view that representations of spiritual reality by different religions are not necessarily in conflict but may actually be complementary in the same sense that the worldviews of science and religion are complementary.

In this connection it should be noted that recognition of the complementarity of spiritual ideas has long been basic to Hindu religions. According to von Stietencron:

A characteristic feature of the great Hindu religions is that they never start out by assuming an irreconcilable opposition between two postulated truths. Any claim to absoluteness is alien to them. They see it as narrowing the range of potential human consciousness. Wherever they find unavoidable contradictions, they view them as lodged within the framework of complementary oppositions, and they try to integrate them into some comprehensive connection. (Qtd. in H. Küng, *Christianity* 146)

...they generally don’t think that, of two differing descriptions of reality, if one is true, the other must be false; but, rather, that each of them is appropriate to the perceptual capacity and understanding of certain individuals or certain stages in the evolution of consciousness. (“World and Deity” 182)

There is yet a further connection between the Bahá'í Faith and complementarity in its most far-reaching extension as conceived by Bohr, viz., in the quest for the unity of mankind. In Bohr's words, the main obstacle to unity of cultures is

the deep-rooted differences of the traditional backgrounds...which exclude any simple comparison (or accommodation) between such cultures. It is above all in this connection that the viewpoint of complementarity offers itself as a means of coping with the situation. (*Atomic Physics* 30)

By thus conjoining insights of 'Abdu'l-Bahá and Niels Bohr we seem to establish, at least in barest framework, a plausible common rationale for three of the more important tenets of the Bahá'í Faith: the unity of mankind, the unity of religions, and the harmony of science and religion.

Returning for a final thought from the edifice analogy, it would seem that the Bahá'í Faith, because it recognizes that all religions reflect the same basic truth and also that religion must go hand in hand with science, cannot simply be portrayed as another religion restricted to viewing a single face of the edifice. It is as though this Faith were mobile, deliberately visiting all faces in order to become totally familiar with the perspective from each, while at the same time acknowledging the relevance of the plan view too. This flexibility, in effect accommodating many complementary or quasicomplementary viewpoints, should serve the Faith well in helping mankind grapple with its mammoth global problems such as nuclear war, which threatens to make a shambles of the edifice in plan and religious strife, which continues to scar and disfigure its form and beauty in elevation. A quotation from Shoghi Effendi is more succinct:

The primary importance of the Cause among the existing religions of the world is that, whereas the others have no coherent program upon which they are united, the Movement is rich with the very spirit and teachings of world needs for solving its present international problems. (Letter, *Bahá'í News* 2)

Summary

The conclusions of this preliminary enquiry into the role of complementarity in the relationship between science and religion may be summarized as follows:

First, difficulties arise because of our limitations in grasping the unity of the world, including physical reality and spiritual reality, in its entirety. At any given time we tend to observe the world through either our scientific eye or our spiritual eye. But the world cannot be completely comprehended through either eye alone. We must accept both views and recognize the fact that, in many instances, when we use the scientific eye, we may learn little if anything about spiritual attributes and vice versa. In due course, one hopes the development of a more unified viewpoint will be inevitable. Meanwhile, an appreciation of Bohr's complementarity principle can encourage us to examine apparently irreconcilable concepts from the two disciplines in full understanding that such dualities do not necessarily spell conflict, but rather they may conjointly mirror the underlying unity of the world.

Second, the edifice analogy is a useful aid in understanding how the viewpoints of science and religion can be mutually exclusive, i.e., in effect, orthogonal, without being in conflict. The analogy should, however, not be accepted as necessarily exact. Thus, while it depicts these viewpoints as rigorously orthogonal, like the plan and elevation views of a building, this constitutes no proof that, in the real world, they actually are orthogonal over the entire field of perceptions comprising each viewpoint. To be so would imply that no substantive statement whatever belonging to either viewpoint would have currency under the other, which would seem indeed a rash conclusion.

Third, Bohr's principle of complementarity is closely related to several other Bahá'í teachings. Thus, 'Abdu'l-Bahá's insight that intellectual knowledge must, in the end, be described in terms of sensible figures of external reality (via metaphor, allegory, or other similar devices) is echoed by Bohr's insistence that quantum phenomena be elucidated in the language of classical physics. But more, while 'Abdu'l-Bahá identifies knowledge of the necessity of such indirect forms of expression as essential to our understanding of intellectual problems, Bohr encourages us to accept disparate, apparently irreconcilable, descriptions developed from different standpoints, as consistent with a single intellectual reality, a reality for which there may exist no single all-encompassing description. Indeed, Bohr's vision in broadest import would appear to reinforce Bahá'í tenets proclaiming the unity underlying different articulations of spiritual reality by various religions and different expressions of human values by various cultures, as well as that underlying the viewpoints of science and religion.

Finally, to my mind the value of the complementarity principle lies not so much in any deep philosophic meaning it may convey as in, as MacKay suggests, its usefulness as a logical tool that encourages a closer look and a deeper tolerance. In short, complementarity teaches that

things aren' t always simply
Black or white
Or even shades of grey.
They can also sometimes be
Both black AND white
in a complementarity way.

Notes

1. "True" religion here refers to the founders' original teachings, devoid of subsequently added dogma or other improvisations.
2. See accounts of Bohr' s life and ideas by various contributors to *Niels Bohr: A Centenary Volume*, A.P. French and P.J. Kennedy eds.
3. This is a paraphrase. In Bohr' s own words: 'Evidence obtained under different experimental conditions cannot be comprehended within a single picture, but must be regarded as complementary in the sense that only the totality of the phenomena exhausts the possible information about the objects.' *Niels Bohr* 123.
4. According to G. Holton, "The Roots of Complementarity" in *Thematic Origins of Scientific Thought, Kepler to Einstein*, 115: "...different experimental conditions give rise to different views of 'nature'. To call light either a wave phenomenon or a particle phenomenon is impossible; in either case too much is left out. To call light both a wave phenomenon and a particle phenomenon is to oversimplify matters." For accounts of this and related concepts in quantum physics, written for the nonspecialist, see for example Paul Davies, *God and the New Physics*; Richard P. Feynman, *The Strange Theory of Light and Matter*; Nick Herbert, *Quantum Reality*; Richard Schlegel, "Quantum Physics and the Divine Postulate," *Zygon* 14(1979):163; Abner Shimony, "The Reality of the Quantum World," *Scientific American* 258(1988):46.
5. "The integrity of living organisms and the characteristics of conscious individuals and human cultures present features of wholeness, the account of which implies a typically complementary mode of description....We are not dealing with more or less vague analogies, but with clear examples of logical relations which, in different contexts, are met with in wider fields." N. Bohr, "Quantum Physics and Philosophy," *Essays 1958-1962 on Atomic Physics and Human Knowledge* 7. According to G. Holton, "Niels Bohr and the Integrity of Science," *American Scientist* 74(1986):237: "The full grandeur of Bohr' s ambition was to apply the complementarity point of view also to the understanding and toleration of differences between traditional cultural systems."
6. As summed up by G. Holton, *Thematic Origins* 154, ".while his [Bohr' s] point of view is accepted by the large majority of physics itself, it would not be accurate to say that it is being widely understood and used in other fields; still less has it swept over philosophy....Even those who in their professional work in physics have experienced the success of the complementarity point of view at first hand find it hard or uncongenial to transfer to other areas of thought and action, as a fundamental thematic attitude, the habit of accepting basic dualities without straining for their mutual dissolution or reduction."
7. For more sympathetic or accepting views see: D.M. MacKay, "Complementarity' in Scientific and Theological Thinking," *Zygon* 9(1974):225; G. Holton, *Thematic Origins*; W.H. Austin "Complementarity and Theological Paradox," *Zygon* 2(1967):365; J. Honner, "Niels Bohr and the Mysticism of Nature," *Zygon* 17(1982):243; H. H. Oliver, "The Complementarity of Theology and Cosmology," *Zygon* 13(1978):19. For more reserved or critical views see: H.A. Bedau, "Complementarity and the Relation between Science and Religion," *Zygon* 9(1974):202; J.L. Park, "Complementarity without Paradox: A Physicist' s Reply to Professor Austin," *Zygon* 2 (1967):382; Richard Schlegel, "Quantum Physics and the Divine Postulate," *Zygon* 14 (1979):163.
8. That science and religion must inevitably grow closer together is argued by Charles H. Townes, "The Convergence of Science and Religion," *Zygon* 1(1966):301.
9. A.R. Peacocke, *The Sciences and Theology in the Twentieth Century* ix, lists eight ways of relating science and [Christian] religion, one of which might be identified with complementarity. H.H. Oliver, "The Complementarity of Theology and Cosmology" lists three ways, one of which is complementarity.
10. William S. Hatcher, "The Science of Religion," *Bahá'í Studies* 2(1980); reprinted in part from *Zygon* 14 (1979):229.

11. One might object that religion in the sense of divine knowledge is all-embracing and thus includes the purview of science and, therefore, that it is improper to consider science and religion on the same footing as implied by examining their complementarity. To allay this concern, we must distinguish between all-embracing divine knowledge and particular theistic descriptions of the world in which, for whatever reason, the methods and concepts of scientific explanation are ignored. See MacKay, *Zygon* 9 (1974):240.

12. The architectural analogy used here appears to have been first suggested by C.A. Coulson in *Science and Christian Belief*. See Bedau, *Zygon* 9(1974):215.

13. For a discussion of these scientific advances see, Robert S. Shankland, "Michelson and his Interferometer" in *History of Physics* 36; Albert Einstein, "How I Created the Theory of Relativity" in *History of Physics* 243. For a modern view of the ether concept see, Nick Herbert, *Quantum Reality* 5.

14. For a discussion of this view see, D. Bohm, "On Bohr's Views Concerning the Quantum Theory" in *Niels Bohr: A Centenary Volume* 153.

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